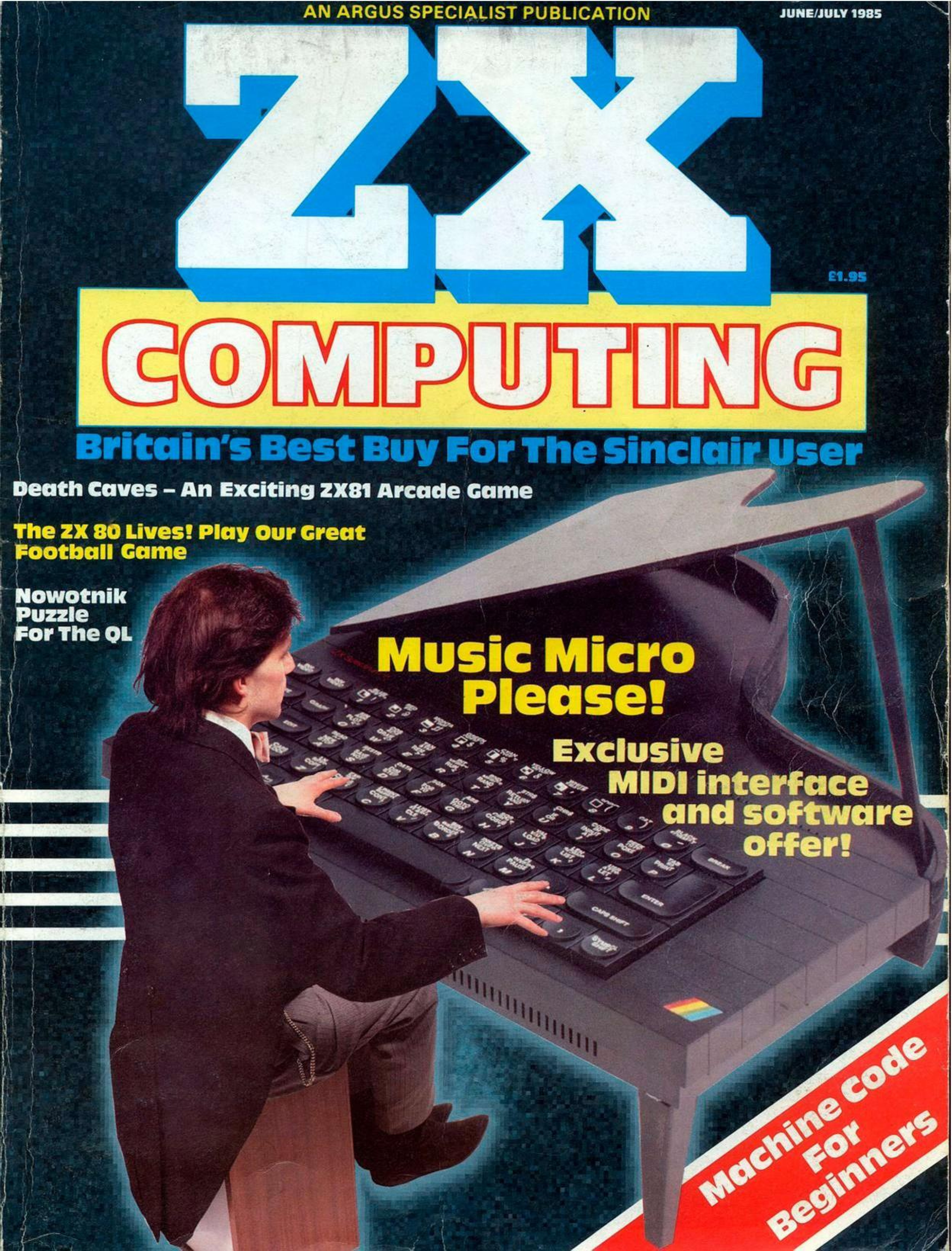


AN ARGUS SPECIALIST PUBLICATION
JUNE/JULY 1985
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"WONDERFUL . . . the graphics are beautifully designed to an incredible degree of detail." (PopCompWkly) "Stunningly sharp, colourful graphics and a truly infuriating and fascinating plot." (Micro Adventurer) Race against time to liberate your 5 sorcerer friends in one of the most playable and beautiful Spectrum games ever. Random start, different game every time. STICKS Kempston/Interface2 (VIRGIN) **CASSETTE £6.95**

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"The superb arcade blast 'em, bump 'em, crash'em all-action shoot 'em up explodes onto your screen with this ace no-holds-barred conversion . . . . a must for any shoot 'em up addicts collection." (ZZAP) You control the turbo racer/hydro spy boat, depending whether you're on land or water. You've missiles, machine-guns, oil slicks, smoke-screens. 2 skill levels. DEMO. STICKS Kempston/-Interface2/Cursor. (U.S.Gold) **CASSETTE £7.95**

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*"A BRILLIANT PROGRAM ALL ROUND; excellent sound and graphics and a great addictive quality . . . well worth having." (PersCompToday)*Over 250 locations and more than 80 individual creatures from over a dozen different races in this magical sequel to 'Avalon'. Wonderful follow-up to a great graphic adventure. STICKS Kempston/Interface2/Cursor. (Hewson) **CASSETTE £7.95**

FORMULA ONE

"A really good strategy game . . . as management games go, it's one of the best." (PopCompWkly) 1 to 6 players. Full simulation of a Grand Prix Racing Season. 16 races. Invest your sponsors' money in drivers, pit-crews, cars: guess at the weather forecasts accuracy and choose your tyres. Then watch the races run in very good and big graphics. As enthralling as the same company's golf and cricket simulations. STICKS Most: (CRL) **CASSETTE £7.95**

PAINT PLUS

"I've never had so much fun with a utility program." (ZX Computing) "If you've been looking for a Spectrum graphics aid, this seems like one of the best." (PopCompWkly) The reviews refer to the original PAINTBOX. This version has 24 new commands and an 88-page colour manual. MICRODRIVE and GRAFPAD compatible. UDG Editor, Drawing Board, Sketch Pad, Precison Plotter and Screen Planner. AMAZING DEMO on flipside. The very best Spectrum graphics kit. STICKS Kempston/Cursor. (Print 'n'Plotter) **CASSETTE £9.95**

SPACE SHUTTLE

"Superb graphics, the cockpit vibrations during the launch really give the impression of taking off." (HomeCompWkly) Fly the Space Shuttle DISCOVERY. Launch, rendezvous and dock with an orbiting satellite 210 miles above Earth, then return to Edward's Air Force Base. Progressive difficulty. DEMO. Great graphics and a very well illustrated manual. Photograph the final screen to earn your free 'wings'. STICKS: Kempston/Interface2/Cursor. (Activision) **CASSETTE £8.00**

SUPERCODE 3

"This amazing collection brings the speed of m/code within the reach of any programmer familiar with BASIC." (PersCompToday)' 'An excellent collection of routines and utilities that no serious user should be without." (C.T.W.) Save/load to/from tape/Microdrive as you wish. 152 Machine-code routines. Helpful instruction manual. The ultimate Spectrum Toolkit. 100% menu-driven. On-screen training. If you're writing in BASIC or m/c, you need this fast! NO STICKS. (CP Software) **CASSETTE £12.95**

TECHNICIAN TED

"Some of the liveliest, detailed and imaginative graphics I've seen ... it must be a game to add to your collection. Truly amazing, truly difficult, truly wonderful. 96%." (Crash) "Has the same touches that made JETSETWILLY so clever and professional: precise collision detection, very carefully constructed screens, nicely designed sprites." (PopCompWkly) **50 SCREENS.** Time limits; continuous music. It's got everything. STICKS: Kempston/-Interface2/Protek. (Quicksilva) **CASSETTE £5.95**

MINI OFFICE

"QUITE EXCEPTIONAL VALUE ... the first affordable program suite I have seen ... I strongly recommend beginners get this first." (PersCompNews) 4 programs on one tape, all working with EPSON-compatible printers. **WORDPROCESSOR : DATABASE : SPREADSHEET : GRAPHICS .** An amazing collection at an unbelievable price, no wonder we've sold so many! (Database) **CASSETTE £5.95**

GYRON

"There is little to rival it in the entire world of Spectrum programs ... utterly original, compulsive." (PopCompWkly) "An astonishing program which requires quick arcade responses, a great deal of thought and should provide hours of satisfying frustration ... the graphics are breathtaking." (Crash) "A brilliant game combining strategy and arcade skills ... a game in which brains and logic count, stands in a class of its own." (Sinclair User) **WIN YOURSELF A PORSCHE 924!** (If you solve Gyron before 21/10/85. There may have to be a tie-breaker competition.) Simpler and harder games on different sides of the tape. 12 levels. ALL STICKS. (Firebird) **CASSETTE £9.95**

SHADOWFIRE

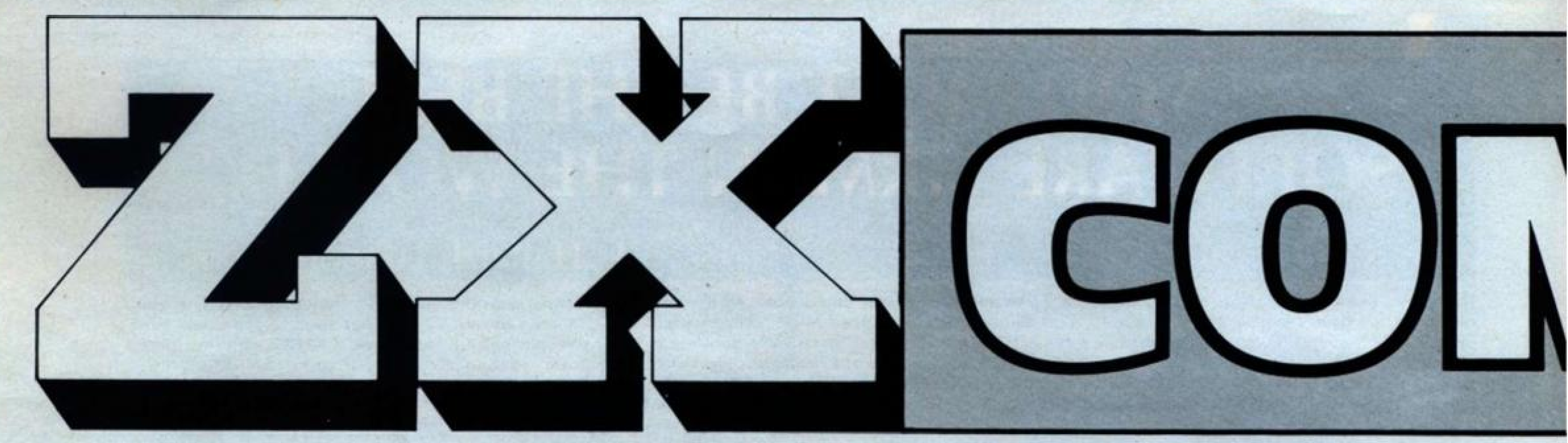
"Graphically superb and seems very complex ... it's going to be a game to savour for some months." (PopCompWkly) **THE WORLD'S FIRST ICON-DRIVEN ADVENTURE.** Makes your Spectrum seem a little like a Macintosh! The best yet from the 'Doomdark' company. Fascinating graphic adventure without words as you organise the Enigma team. 3 different missions. Stunning graphics. 20-page full-colour manual. You have 100 minutes to win! Demo helps. STICKS Kempston/Interface2. (Beyond) **CASSETTE £9.95**

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Signature: ____
Please write clearly. If we can't read it, you won't get it.
Name: ____
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____ Postcode: ____
PHONE NO: if any, in case of query ____

Program Name	Price
Postage & Packing UK add 75p per order	
Europe ADD £1.00 per program	
Outside Europe ADD £1.50 per program	
Total Order	



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CONTENTS

ASP FIGHTS SOFTWARE PIRACY

Much has been said and written in condemnation of software piracy but few have taken a positive stand against it. ASP is among those few that have taken action to help curb the grave problem of home copying of commercial software.

ASP has already taken steps to eliminate advertisements in our magazines which relate to tape duplication for piracy purposes. While it is appreciated that individuals may take 'back-up' copies of their own programs, it should be noted that it is *ILLEGAL* to copy commercially available software for other than personal use.

Software piracy is costing the software industry huge sums of money which is detrimental to the future development of the industry. It is in everybody's interests to dramatically reduce the level of software piracy primarily because firms need funds raised from software sales to plough back into research and development of new products. This means that the standard of software products can only improve.

ASP hopes our action will help combat this serious problem in order to maintain and improve the high standards of the UK software industry. We are asking *you* to do the same by refraining from duplicating or copying commercially available software for anything other than personal use.

MPUTING

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ZX Computing is constantly on the look-out for well-written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration for publication.

All submitted material should be typed if possible; handwritten work will be considered, but please use your neatest handwriting. Any programs submitted should be listed, a cassette of your program alone will not be considered. All programs must come complete with a full explanation of the operation and, where relevant, the structure; Spectrum programs should be accompanied with a cassette of the program as well as the listing.

All submissions will be acknowledged and the copyright in such works which will pass to Argus Specialist Publications Ltd will be paid for at competitive rates. All work for consideration should be sent to the Editor at our Golden Square address.

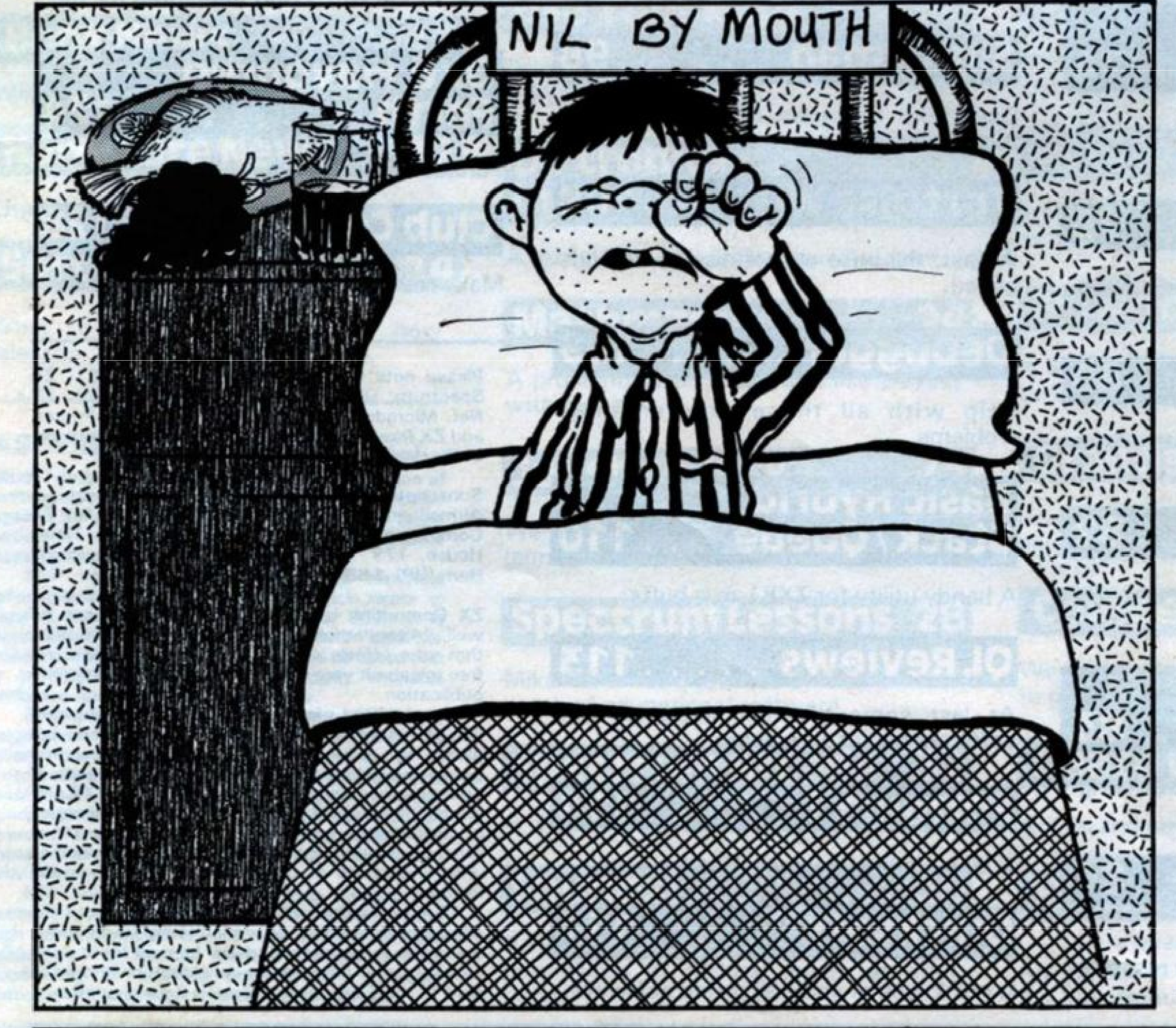
WELCOME

On Friday I had something to eat at lunchtime. So what? you say, there's nothing special in that. Well, the significance was that by Monday I'd been lurched into hospital with a rather overheated Pancreas. For those of you fortunate enough not to have experienced this, it can only be described as having a berserk football fan repeatedly stab you in the stomach with a red hot penknife. So, groaning and cursing — this was my fourth attack in five years — headlines read PANCREAS STRIKES AGAIN — NHS BAFFLED. Anyway, mumbling incoherently, I was attached to a plethora of tubes, needles and wires, questioned in detail about my intimate bodily functions, given a pain killing injection and handed over to those aptly named beings, the Angels. (Nurses)

Now, if you've ever been in hospital then you'll know there is one sign which strikes dread into the hearts of the most hardened. No it's nothing as simple as INFECTIOUS or PLAGUE, it's the three words NIL BY MOUTH. These are attached to patients such as I and mean just that. Feeding is intravenous, nothing is swallowed. Well, after a couple of days as the pain subsides and the injections wear off and an interest in human occupations returns, then those words strike into the depth of your being. It matters not that you are in no danger of malnutrition due to the saline pumped into your veins, the hunger builds. The rattle of the tea trolley, cheerful calls of "What do you want to eat today Mr, ?" to more fortunate patients become a torture more refined than any deliberately devised by man.

I don't want to force the point down your throats, (or is that turn of phrase too inappropriate?) and I don't want sympathy (then again . . .) But if I felt like that after two days then you can imagine how those in Ethiopia feel after many months. I'm told the pain fades with time and that I find awful as well. And I know the media go on and on, T.V., newspapers all trying to show the most horrific picture. But we ought to be horrified and we ought to keep having our noses rubbed into it and maybe we will buy the record or the software tape and pay out £1.25 or £4.99 and feel smugly pleased with ourselves.

But until we've tried going hungry even for a day, we cannot begin to imagine the horror of the situation. So I'm asking, if you haven't yet bought SOFTAID (if you have, then get a copy for a friend) PLEASE buy SOFTAID and make it stay No.1 in the charts for a long time.





GPO PS.

Things are still not as they should be, if you have sent in a program or enquiry and more than six weeks have elapsed without our replying then moan at them. We know for certain that a number of letters and parcels sent to our offices have not arrived. If enough of us complain then they'll get fed up and do something just to get us off their backs!

Something Different

Some of you may have noticed that we were getting a little behind (there's a joke there somewhere) with our reviews of new software. Now obviously a bimonthly magazine is unlikely to be as up to date as a monthly, nonetheless we are now going to attempt to provide more up to date reviews than we may have done previously, and to that end we have recruited a bunch of jaundiced arcade addicts ('Gimme another shot man') to sweat blood over the latest releases. These dedicated persons (including me!) are all enthusiasts who have died a million deaths at the hands of aliens, crashes, falls etc. Even so they still only give their own opinions and I'm sure you may not agree with them at times so write in and let us know!

If Music Be The Food . . .

In this issue I reveal the results of an exciting investigation into the use of the Spectrum in the expanding field of home music, not aimed at the musician or the fanatic but at ordinary people — US. All the equipment has now been returned, the office has a strange empty quality, Cliff and the typists have removed their ear plugs and my fingers itch. What can I stick them in next — Cliff looks anxious — I wonder . . .

On with the show, overture, curtain, dancing girls . . .

Warning

We recently received this message from Dean Electronics:

'Dean Electronics Limited, the sole authorised importers of Alphacom printers, wish to issue a warning to anyone purchasing an Alphacom 32 printer for use with a Sinclair home computer.



Alphacom 32 — The real McCoy

Recently printers have been introduced into the market place which are similar or even identical in appearance to the Alphacom 32 and have connectors which will fit the 9v DC power socket on the Sinclair Spectrum. In some cases these connectors will provide 25 volts AC to the Spectrum not the required 9 volts DC and will destroy the computer.

Dean electornics wish to point out that they are in no way associated with any such product. The authorised version of the Alphacom 32 supplied by Dean is fitted with a fail safe power supply and it is not possible to accidently plug this into the Sinclair Spectrum.

The authorised version of the Alphacom 32 printer is available from W H Smith's, Currys, John Menzies, Prism Distribution, Terry Blood Distribution or direct from Dean Electronics Ltd.'

POKEs

Dear Sir
I am in the process of compiling a book for Spectrum Games-players, which will include hints and tips for adventure games and POKE's for infinite lives etc for arcade games.

I would welcome contributions from your readers and should any be used in the book then the sender will be subsequently rewarded.
Yours sincerely
H ZUCHOWSKA
37 Grove Gardens
Off Grove Lane
Handsworth
Birmingham

Absent Minded

Dear Ray,
Using my favourite program WORDSHEEP and my ALPHACOM 32 printer I often curse my memory forgetting what I typed just 10 seconds before. This is the occasion:

Having filled a screenful of text I press CAPS SHIFT + 9 to send it to the printer and afterward CAPS SHIFT + 4 to clear the screen. And now I just can't remember which was the last word! I can't see it because it is still under the paper tearing edge and I can't press the advance key because there would be an ugly gap in the text.

Thanks to the genius of Toni Baker there is a simple solution by using the YOURS routine for a slightly altered version of the CLEAR SCREEN routine which will clear only the upper part of the screen; I omitted 3E80h and 32B15Ch and changed 01DF02h into 015F02h. This spares out L-TABLE from clearing. The new CLEAR U-TABLE routine must be attached to the WORDSHEEP program which ends at 60957 and this will do it:

```
1010 RESTORE 1040
1020 FOR n=60958 TO
     60977
1030 READ a; POKE n,a;
     NEXT n
1040 DATA 33,0,232,34,
     175,92,1,95,2,62,
     32,205,57,236,205,
     12,236,195,229,235
```

And now;

Write a screenful of text plus the next words in the lower part of the screen, send the text to the printer and afterward press CAPS SHIFT + SYMBOL SHIFT. Your last words will stay on the screen to the great relief of that short time memory sieve!
Sincerely yours,
Louis Colombier
W. Germany

Froggy II

Dear Sir,
I have just read the review of Software Farm's Frog Hopper II game in the October/November issue of your magazine. It was in the ZX81 Soft Selection.

I don't know who reviews these games, but whoever does makes a very poor job of it. The reviewer says, "there is only one speed, which is perhaps a little slow" — this is totally untrue as the game speeds up with each difficulty level. This is obvious to anyone who has played the game for more than five minutes. I hope you will correct this mistake in a future issue.
Unsigned

Consider it corrected.

Help!

Dear *ZXC*,
HELP!! I am a regular subscriber to *ZXC* and I have numerous programs that will not run. My copy of Meteor Madness tells me that I have faults that do not exist (or that I cannot find), and I am still trying to get out of the market place in Chalice. Most others that I copy tell me that it is 'Nonsense', with monotonous regularity. Is there anyone in the Tamworth area with enough patience, who can assist me? I would ask my seven year old son, but my ego has already taken a severe bashing.
Desperately yours,
George Bunn,
98 Stonepit,
Kettlebrook
Tamworth
Staffs.

Buyers' Guide

Dear Mr. Elder:
I am publishing a "BUYERS GUIDE TO SINCLAIR — TIMEX PRODUCTS & SERVICES" and wish to include information on your publication in it. there is a need for quality publications, such as yours, to keep users informed about their computer. Information on subscription rates, correct mail address, and a description of what is featured in the publication would make sure that you are listed correctly. If you do not distribute overseas (to USA & Canada especially) please send the information anyway. I will make note of that fact in the guide.

I wish to make the guide as complete as possible covering ALL Sinclair and Timex computer products and services. With this in mind I have already sent over 1200 requests for product information out world wide. Most requests where sent to US firms or individuals that have products or services, but over 100 were sent to the United Kingdom. Only ten of these firms answered the request, so I am requesting your assistance in gathering information. If you could supply a list of advertisers that I may try to contact or if you could make mention of my need for information in your publication, this would be a great help.

The guide is a full size 8½" × 11" set in a three ring binder that allows for easy updating. Now containing over 120 suppliers of Sinclair-Timex products from the ZX-80 to the QL and the TS-1000 to the TS-2068. Over 800 software titles are listed along with over 100 books and hardware items. Priced at (US)$20.00 postpaid to USA and Canada, others add $1.50 surface or $5.00 airmail, this includes an update to keep it complete in 1985.

I will send you a complimentary copy if you so request it. I am looking forward to hearing from you as soon as possible to make sure that your information gets in the next update. Thank you for your time and consideration in this matter.
Very truly yours,
Dale F. Lipinski

We've sent on what info we've got, meanwhile, maybe some of our advertisers will read your letter — Ed.

POKEs

Dear *ZX Computing*
I am a 15 year old student and I own a 48K ZX Spectrum. One day playing around with the POKE command, I finally came up with a short program which I find very useful. Once placed before your program it will erase everything if BREAK/SPACE is pressed during the program; a good program to prevent your program being changed. Here is the program:

```
10 POKE 23613,2
20 POKE 23614,91
30 POKE 23298,0
40 POKE 23299,0
50 REM YOUR PROGRAM
   SHOULD START FROM
   HERE
```

I hope that if you print this in *ZX Computing* the readers will find it useful. I find *ZX Computing* a great magazine and am an en-

thusiastic reader; keep up the good work!!
Yours faithfully
HARRON ANSARY
Lusaka, Zambia

Anomalous Phenomena?

Dear Sir,
As a member of the Association for Scientific Study of Anomalous Phenomena I am interested in cases of anomalous computer effects.

Can I appeal to readers for any information, at first or second hand, no matter how bizarre, concerning unexplainable malfunction or unexpected output? All accounts will be treated in strictest confidence, and should be sent to:
Roger C Morgan
15A Kensington Court Gardens
London W8 5QF

Golden Chalice

Dear Sir,
Just wanted you to know how much I enjoy your magazine. More's the pity it couldn't be brought out monthly! I started computing November '83, and haven't switched off my TV since!

My admiration and congratulations go to Alan Davis for "The Golden Chalice". I almost pulled my hair out trying to solve it, but it's worth going bald over: well worth five stars. Let's have more mind-benders like this. Your last edition (Oct/Nov) was too ZX81 orientated: I have a Spectrum, so I'm biased; let's have more balance.

Wishing you, the staff and all readers the best for '85.
Regards
Laurence Creighton
S. Africa
P.S. Anyone want a code to Break Into "Manic Minder"?? Write to me enclosing a S.A.E. with I.R.C's.



Bad Attitude

Sir,
In previous issues of your magazine, as well as other magazines catering to owners of Sinclair machines, I have from time to time come across letters from readers praising the after-sales service offered by certain software houses.

I too have had similar experiences but in addition, as a user of mainly business and utility software, I am especially pleased that there are software houses which market such software who offer an update or exchange deals to their existing customers. Such software houses realise the importance of customer relations and so benefit from the most effective and yet the cheapest form of publicity that is available to anyone. I refer to advertisement through word of mouth from their satisfied customers.

Regrettably, CP Software is not such a company! It is indeed most unfortunate that they do not believe in offering their customers an after sales service to equal, let alone rival companies such as OCP, MICROSPHERE, LERM, and CAMPBELL SYSTEMS, to name a few.

I bought a copy of CP Software's "SUPERCODE II", which is an excellent utility program, as well as their "BRIDGE PLAYER", "BRIDGE TUTOR — ADVANCED" & "BRIDGE TUTOR — BEGINNERS" and have been very pleased with all of them. In fact I went as far as to review their "BRIDGE PLAYER" program in the "READERS' REVIEWS" section of your magazine. However, when I recently came across their advertisement announcing "SUPERCODE III" and "BRIDGE PLAYER 2", I very foolishly believed that they, like some of the other software houses mentioned above, would also offer their existing customers an update service. But no! I was told quite bluntly that they would only exchange faulty tapes and if they upgraded their programs, then they would draw the line there.

It is sad that CP Software should take this attitude and all I can say to them is, they should take a lesson in customer relations from the companies that I have mentioned earlier in this letter.
Yours faithfully,
S. Datoo

I.S.U.G.

Sir,
I would like to bring to the attention of your readers what some "computer clubs" truly are. In July of last year I sent an application together with a cheque for £14 to VIC WEBBER ISUG (i.e. International Spectrum Users Group ?????) of 189 Rosehill Road, Burnley, Lancs., BB11 2QX, after reading about the "club"(sic) in a magazine. On paper the "club" really seemed a good one but in truth it's a real NOTHING. I never even received an acknowledgement of my application let alone any newsletters. I wrote back three times since mid-September after I learnt that the cheque had been cashed on the 4th September, twice through registered mail to make sure that my letters reached their destination. However I never got an answer to these letters either. My conclusions are that the ISUG is another way for its organiser/s to make a quick buck. (Does a Vic Webber really exist?)

I wrote to you hoping you would publish this letter so that your esteemed readers would not be cheated out of their money just as I have been. It would also be a good idea were Computer magazine publishers to check on the authenticity or otherwise of the clubs mentioned in their columns.
Yours sincerely,
Charles Bajada
Malta

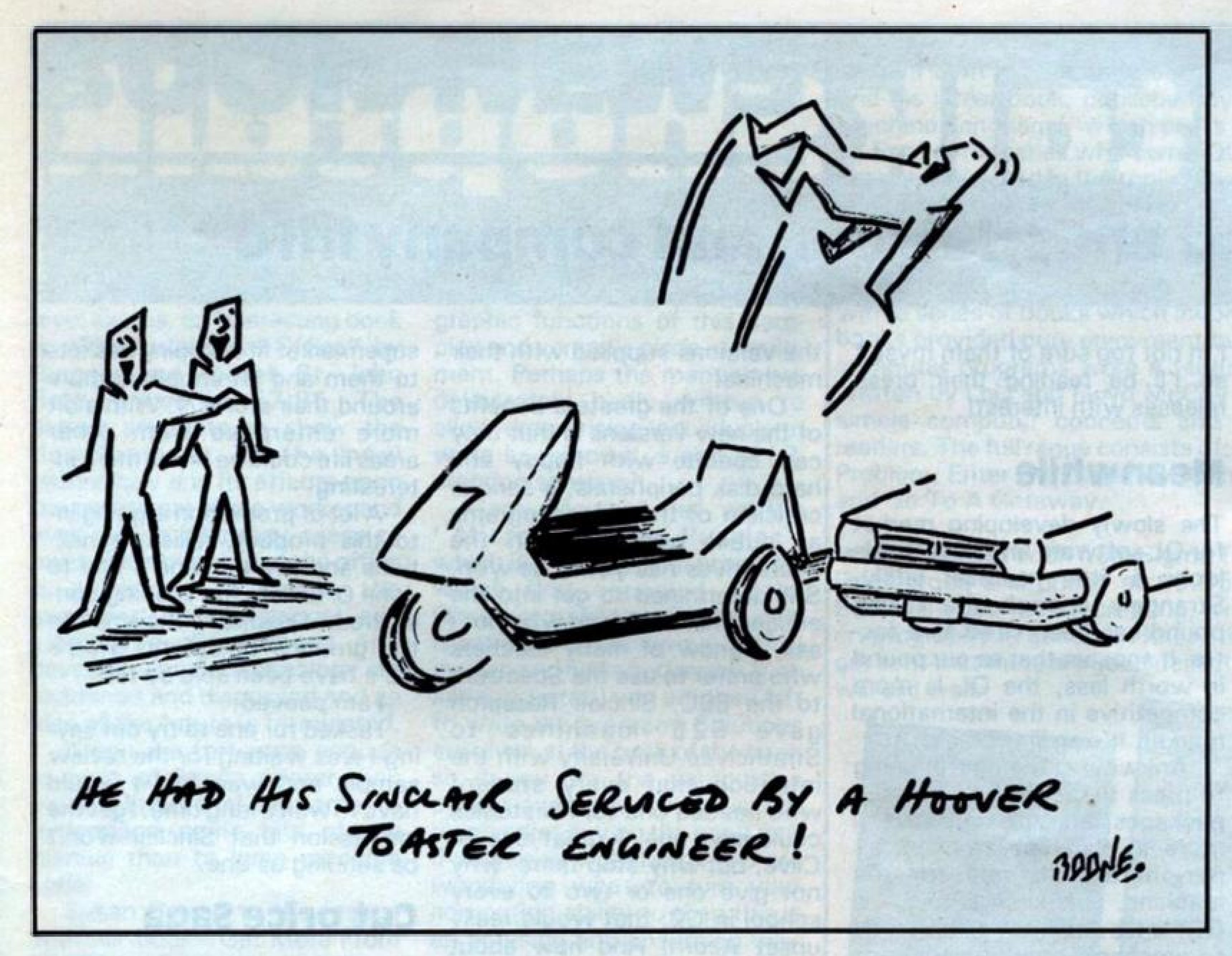
I.S.U.G.

Re: International Sinclair User Group.
I write to enquire whether any of your readers have encountered a problem similar to mine. In June 1984 I paid £10 to the Independent Sinclair User Group, 189 Rosehill Road, Burnley, Lancs as my first annual membership fee. Within a few days I received the first newsletter. Since then, despite writing several letters, I have received nothing further. Neither have I had a reply to my letters.

I consider that I am therefore justified in denouncing the ISUG as nothing more than a sham. It is reputedly run by a man called Vic Webber. If Mr. Webber is reading this letter I would invite him to justify his lack of action with money belonging to other people. If any of your readers have had this problem, or indeed if they have had successful dealings with this group, I should be obliged if they would write to me as soon as possible. I am contemplating a certain course of action but would welcome comments from other interested persons before I do so.
Yours sincerely,
John Scholfield,
Blackburn, Lancs.

Bank Charges

Dear Sir,
After reading your article about joystick interfaces for the Spectrum, I ordered by bank draft a stick at Downsway Electronics, because you tested it as one of



the best. Unfortunately the bank in England deducted £3 in charges, so I phoned Downsway how to handle this. They said, they would send the joystick to my address, so ignoring the £3 they did not get. Otherwise I would have had to pay again by bank £3 and £3 costs. I think this is a way of service giving of more than 100%.

May be it should be useful if you could indicate in your magazine a way to handle for readers on the continent to send money to your advertisers. Now the total extra costs for me were £2 at the bank in Holland, £2 at the bank in England, about £3.50 plus £2.75 for import tax and tax administration fee.

Yours faithfully
H. A. van Brakel
Parnassiaweg 9
8881 CE West Terschelling
Holland

Well, personally, when I've had to send money abroad I've found an International Money Order, bought from a Post Office (no bank charges!) the best way of doing things — Ed.

Wafadrive

Dear Ray,
You mentioned in the Dec./Jan. issue of *ZX Computing* that you intend shortly to give a detailed report of the Wafadrive. Although I still think it is a splendid item, I think that I have found a small 'bug' in its ROM.

You have probably come across it yourself already, but if you have not, the enclosed copy of my letter to the manufacturers will explain it. It may be something that you would like to pass on to the readers.

"Recently, I bought a Rotronics Wafadrive, and although I am delighted and impressed with it, there is one small point which I find inconvenient, and which makes me think that I have stumbled upon a 'bug' in the Wafadrive ROM.

If you are trying to save onto wafer a block of machine code which resides at the top of the memory, it is impossible to save byte 65535. The necessary instruction, such as 'SAVE ✱ "name", 65501, 35' produces the report 'Out of range'. I have tried to save the byte by itself, but SAVE. . . 65535,1 produces the error report, and SAVE. . . 65535,0 does not save the byte.

For the same reason, it is impossible to save all the User Defined Graphics. The usual instruction 'SAVE ✱ "name", USR "a", 21 ✱ 8' produces the same error report, though if you are prepared to save only 20 UDG's, all is well.

The only solution that I have so far found, is to PEEK 65535 before saving the code, and to save it with a BASIC loading line such as 'LOAD ✱ "name": POKE 65535,n' (n being the PEEK value of 65535). This is effective, though a little cumbersome.

I suspect that somewhere in the Wafadrive ROM is a checking routine which ensures that the address does not exceed 65535, but that the ROM writer has overlooked the fact that, when saving machine code, the sum 'starting address + number of bytes' = 65536. My purpose in writing to you is to ask whether you can suggest any short machine code routine which would correct this, and which could be used whenever it was necessary to save byte 65535. I should be most grateful for any help that you are able to give me."

I will let you know what they say about it, if they reply.

Yours sincerely,
(Mrs.) Carol Brooksbank
Tile Hill
Coventry

More POKEs

Having been a ZX-81 computer enthusiast for a few years now, I have picked up many bits and bobs which have helped me on my journey through BASIC. I have compiled a list of some of these bits and bobs into the following list:

RAND USR 836
This is a loading function which loads your program and automatically breaks into it. To use the function, type in FAST and then RAND USR 836.

USR 3086
This function scrolls the screen and prints something at the same time. To use it in your program, type in PRINT TAB USR 3086;"whatever the message is" or if you want to want it 5 spaces from the beginning of the line, PRINT TAB USR 836 + 5;"whatever the message is".

RAND USR 0
This function clears all memory including whatever is above RAMTOP. It is also a quick way of restoring RAMTOP to normal if you have lowered it.

POKE 16419,x
This function will LIST any line from 0 to 255. Just LIST the line that you want to view from (e.g. LINE 17) and then type in POKE 16419,x where x is the line which you have just LISTed.

POKE 16418,0
This function will allow the use of the bottom two lines of the screen. Use the statement with a program, as it will not work after the program has been broken into or if it is not a program line or after the program has stopped. Do not INPUT or SCROLL in this mode, as the machine will crash. To get back into normal mode, type in: POKE 16418,2.

POKE 16510,0
If you have a machine code routine at line 1, and you do not wish it to be accidentally edited, type in POKE 16510,0 and line 1 will change to line 0. This line cannot be edited. If you want it changed back to line 1 again, type in: POKE 16510,1.

POKE 16389,68
If you have got a RAM-pack connected, and you wish to go into 1K Mode without disconnecting the RAM-pack, then you can lower RAM-TOP to 1K by typing in POKE 16389,68 and then NEW.

POKE 16389,128
If you are in 1K Mode, and you would like to get back to 16K Mode without losing your program, type in FAST and then POKE 16389,128. Now type in LIST and WAIT.

Yours faithfully,
S. Huggins,
Northampton. ■

Shoptalk Shoptalk

Odds and ends, letters, and company info

OCP and Watford = Business

The OCP suite of office programs Stock, Purchase and Sales Manager really provide impressive power for a small business, handling 6000 items as a standard and up to 15,300 items if required.

The choice of the Watford Electronics disk interface from those available was explained as ideal because of the compact DOS, the small amount of Spectrum memory required by the system, its speed, and high capacity (800K on a single double sided disk up to 3.2Mbytes with a four drive system!).

This is in line with the existing program available with this system, Tasword II, Masterfilm and Omnicalc is supplied on disk with the system as part of the package.

I have been convinced of the potential of the Spectrum for serious use for quite some time now, in fact this issue is typed on a Spectrum with Saga 1 Emperor keyboard, Tasword II, Euroelectronics ZXLprint III, Centronics printer interface and a Shinwa CP80 printer, so it is good to see companies taking advantage of its capabilities.

QL Drive

It is no secret that Sir Clive is disappointed at the response to the QL in respect of the number sold but rather than cut and run, Sinclair Research have decided to put more money and more promotion into their wonder machine.

One of the problems is that the market has moved on from the hobbyist/enthusiast owner who could discuss at length the relative merits of the Z80, 6502 and the 68000 CPU to the general user who simply looks at the amount of equipment he gets for his money. In this light who can deny that the Amstrad looks to be one of the best deals? However, Sinclair are convinced that they can educate the non-specialist into understanding what the benefits of the QL are, I must say I'm not too sure of them myself so I'll be reading their press releases with interest!

Meanwhile

The slowly developing market for QL software and peripherals looks a little healthier lately. Strangely enough the falling pound has been cited as a factor. It appears that as our pound is worth less, the QL is more competitive in the international market. It's an ill wind etc, etc;.

Anyway, at the time of going to press there are 33 software packages, available with several more in the pipeline, and 17 peripherals on sale for the machine. One such package is GST's QL Assembler, this tends to emphasise the 'serious' use of the machine as only keen programmers or commercial writers are likely to want to use machine code.

The other interesting thing is the price, £39.95. Those who upgraded from the Spectrum will be upset at the price of QL software, but you have to bear in mind that the machine was designed as a business machine and business users are used to paying in the hundreds for their software due to the limited sales such programs can be expected.

QLUB revamped

Not only the software but also the organisation has been modified and now members of the QL User Bureau have better facilities.

For a start, membership is free to all purchasers of the QL after March 4th upon product registration (that'll peeve those who paid!), and a free telephone helpline service is available from Psion between 9.30 and 5.30 every weekday.

Old members of the QLUB may feel less irritated however as they will not have to pay for the new, improved version 2.0 of the Abacus, Archive, Easel and Quill programs. Non-members are being charged at £15.00 per program or £50.00 for the set. New owners should, of course, check that these are the versions supplied with their machine!

One of the greatest benefits of the new versions is that they can operate with floppy and hard disk peripherals, a serious criticism of the older programs as public confidence in the microdrives has yet to be won. Still determined to get into the educational field, and why not I ask, I know of many teachers who prefer to use the Spectrum to the BBC, Sinclair Research gave 525 machines to Strathclyde University with the intention that every student who needed one for his studies could have one. A great idea Sir Clive, but why stop there, why not give one or two to every school in GB, that would really upset Acorn! And how about one for our office while you're at it. Thanks. . .

QL steps out

Sinclair's aim is to sell 200,000 QL's in the UK this year and I hope he achieves that target, but there will no doubt be a few minor modifications before the public take it to their bosom, it could do with a drop of £50.00 or so for a start. Outside the UK, Sinclair will be launching the QL via mail order in the United States for $499. Managing Director Nigel Searle will be heading the operation which will include marketing and collaboration with American Express. A similar arrangement some years ago led to 50,000 sales of the now mythical ZX80, and Sinclair obviously hope to repeat this success.

C5 trundles on

The C5 has gained a certain notoriety, especially as it is a fairly regular star of Spitting Image. Many members of the public have taken to it and I suspect that it is because it looks like fun, not a word usually associated with travel nowadays.

Quite a few retail shops have decided to stock it including Comet and selected Woolies (why doesn't some enterprising supermarket fit shopping baskets to them and let shoppers drive around their stores?). With a bit more enterprise from other areas life could be much more interesting!

A lot of promotion is going into this product, rallies, exhibitions and even a Land's End to John O'Groats run is being considered. Despite criticisms on the grounds of safety, 5,000 CS's have been sold so far.

I am peeved!

I asked for one to try out saying I was waiting for the review sample and was told I would have to wait a long time. I get the impression that Sinclair won't be sending us one.

Cut price Saga

Saga Systems have cut the price of their Emperor keyboard for the Spectrum. Explaining that drop from £54.45 to £49.95, Saga's David White commented that: "because we have now reached sales of 10,000 units, the manufacturing cost has fallen and we have passed this reduction on to the consumer."

David White also remarked that the Emperor is compatible with the Spectrum+, though quite how that would work escapes me at the moment. Nonetheless the Emperor is a nice unit and received a good review in our February issue.

Also on the way from Saga are a Graphpad and joystick interface which, used together will allow you to draw pictures onto the television screen using a joystick. Further details should be available shortly. Saga can be contacted at 2 Eve Road, Woking, Surrey GU21 4JT.

New Gen Squash

The latest in the long and increasingly sweaty line of games based on sports is New Generation Software's 'Jonah Barrington Squash'. Developed with the help of no less than Jonah himself, the game features voice synthesis which announces the scores. The price is not yet known, but hopefully we will review the game next time around. ■

BOOK NEWS

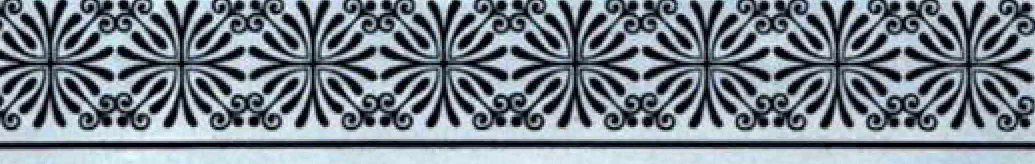
Collins Collection

For general interest or CSE/O level exams, an interesting book is "The Automated Office" by Burgess and Joseph St. John Bate, priced at £7.95. The author attempts to show the development of the new technology and its effects upon the traditional office worker and even which jobs may cease to exist. Each member of the office is examined in detail, the secretary, clerk, manager and executive. Equipment and developments in technology are examined and discussed and an idea of the future is formulated.

If you are fortunate enough to own an Epson printer then you will know that it is harder to understand some bits of the manual than to learn machine code!

Susan Curran to the rescue with her book "Get More From The Epson Printer" which costs £7.95. This is well written, much easier to understand and contains information and instructions on the text and graphic functions of this complex and versatile piece of equipment. Perhaps the manuals are deliberately badly written to allow enterprising individuals to write books on it, a sort of job creation scheme?

Garry Marshall has written "Microcomputer Puzzles" which is a collection of problems which first appeared in the Observer magazine. Each puzzle is set up with background information and hints and techniques are suggested, you are then left to write the program. Solutions are given at the back of the book so if you are the compulsive peeker type then there is not much point buying the book, but if you enjoy a challenge and are wondering what to turn your computing ability to then this is an amusing and absorbing way of spending some time. £6.95



In . . . . Brief

● Fontana have an interesting range of books on the market for the Spectrum and even one which includes the ZX81. Carolyn Hughes has written the 1st and 2nd "Steps With Your Spectrum" at £1.25 and £1.50, "Tim Hartnell's Giant Book Of Spectrum Games" is £3.95, "The Good Software Guide" by Matthew Spencer is £3.95, "Better Programming for your Spectrum and ZX81" and "New Adventure Systems for the Spectrum" are both by S. Robert Speel at £3.50 and £3.95.

● Andrew Pennell has written "The Sinclair QDOS Companion" which gives would-be machine code programmers a good idea how the QL performs and how to utilise some of the powerful features built into its operating system. £6.95 from Sunshine Publications, 12/13 Little Newport St, London WC2H 7PP. Also from them is "Sinclair QL Adventures" by Tony Bridge and Richard Williams which features a specially devised adventure generator. £5.95.

' Attention all TEACHERS! If you're browsing hoping to make sense of this technology because the Head has dumped a computer on you then I recommend "Computers In The Primary School" as a book full of advice, simple beginners instructions, ideas, suggestions and reviews. Perfect material and should be compulsory reading, available from Macdonald & Evans Ltd, Estover Rd, Plymouth and written by Terry Russell.

● "Beginning BASIC with the ZX Spectrum" (&Spectrum+) by Judith Miller is published by Macmillan at £5.95 and is a straightforward guide to programming concentrating on practical examples.

The more complex maths functions are deliberately omitted and at the end of each chapter some questions and tasks are set — there is an excellent chapter on making music! If you want to study programming then this could be the book for you.

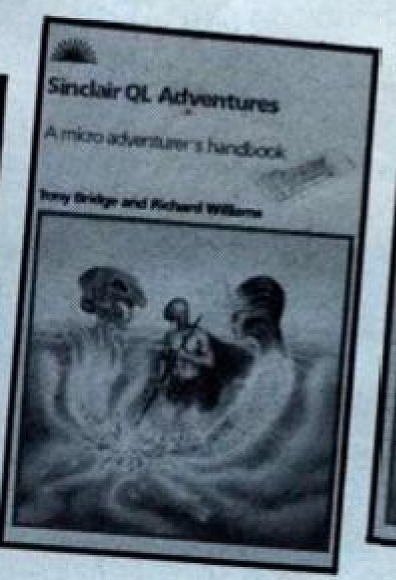
● Our own regular contributor Alan Giles is a professional writer and his latest book, published by Melbourne House is "Quick QL Machine Language" which costs £7.95.

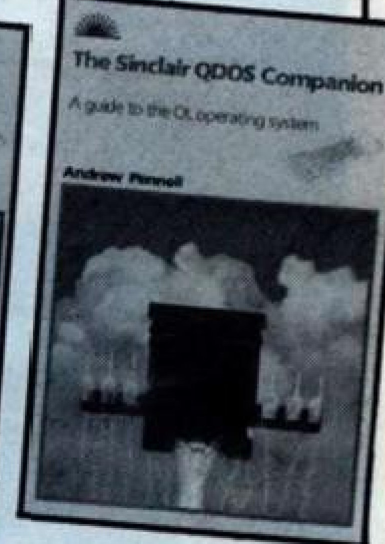
Fans of his series who own a QL will no doubt rush to get it, if you are not interested in the topic on which he writes for us at least you can read it to get an idea of his literary style. It's well produced as are all the books we've seen from this company.

● Fontana Paperbacks came out with a great idea some time back with a series of books which involved the "Bytes Brothers". These books provided pure enjoyment but also some educational value as computer programs were a feature of each episode. They are all written by Lois and Floyd McCoy and at £1.25 each they provide simple computer concepts and a means of motivating slower readers. The full range consists of: Input an Investigation, Program a Problem, Enter the Evidence, Compute a Clue, Record a Robbery, and Go To A Getaway.

● An unusual book from Sigma Technical Press, written by Gareth Greenwood and priced at £6.95, the "Micro Cloak and Dagger Book" is a book about creating, writing and solving codes and about cryptography in general. I know from the letters and programs we get sent that there is a good deal of interest in this field and I expect it will sell well.







● Accolade indeed when a book such as "The Sinclair Story" is published by Duckworth. Written by Rodney Dale and priced at £9.95 I'm sure the interest in this erstwhile folk hero of the masses (and that includes yours truly) will ensure good sales.

● "Capital Radio's Book of Computers & Simple Programming" is jointly credited by Interface Publications as being written by Kelly Temple (Capital Radio DJ) and Roger Munford (Ex ZX Computing Editor) and Peter Shawe (Ex ZX, Computing contributor). Obviously we wish them well with it and it's nice to know there's life after ZXC!

● Sinclair's Logo program is comprehensively documented and I was surprised to see "Logo on the Sinclair Spectrum" by Graham Field published by Papermac.

As I glanced through I realised that this is actually a nice complement to the manuals supplied and suggests alternative means and methods. Logo is such a vast and versatile language that no doubt it could support several books like this without exhausting the possibilities.

● "Machine Code Extensions for Spectrum Basic" by Rob Baines and published by Hewson Consultants at £4.95 is a superb collection of routines which add BASIC commands such as PROC, DEFPROC, ENDPROC, IF/THEN/ELSE.

Careful entering and a fair bit of time is needed to enter all these routines but it is a task worth undertaking if you intend doing a lot of basic programming.

● Two books from Century Publishing Co, Teach Yourself Assembler Z80 by Paul Overaa and "Assembler Routines for the Z80" is by David Barrow and both are £7.95.

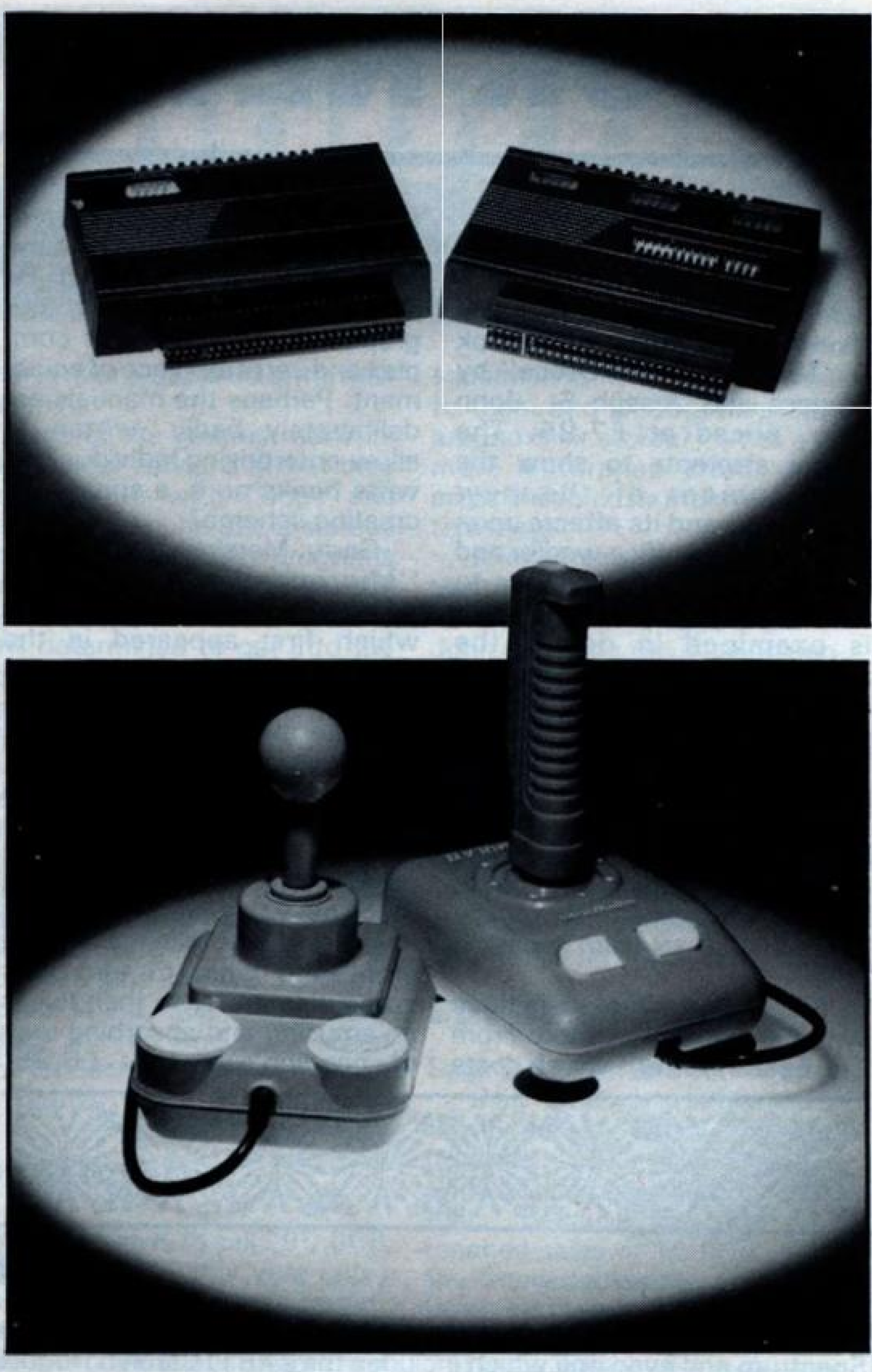
The first is a rather general but nonetheless good book and the second is a collection of general routines, most of which can be used on the Spectrum or ZX81 but is most suited to the programmer who thinks in Hex and considers Basic beneath contempt. ■

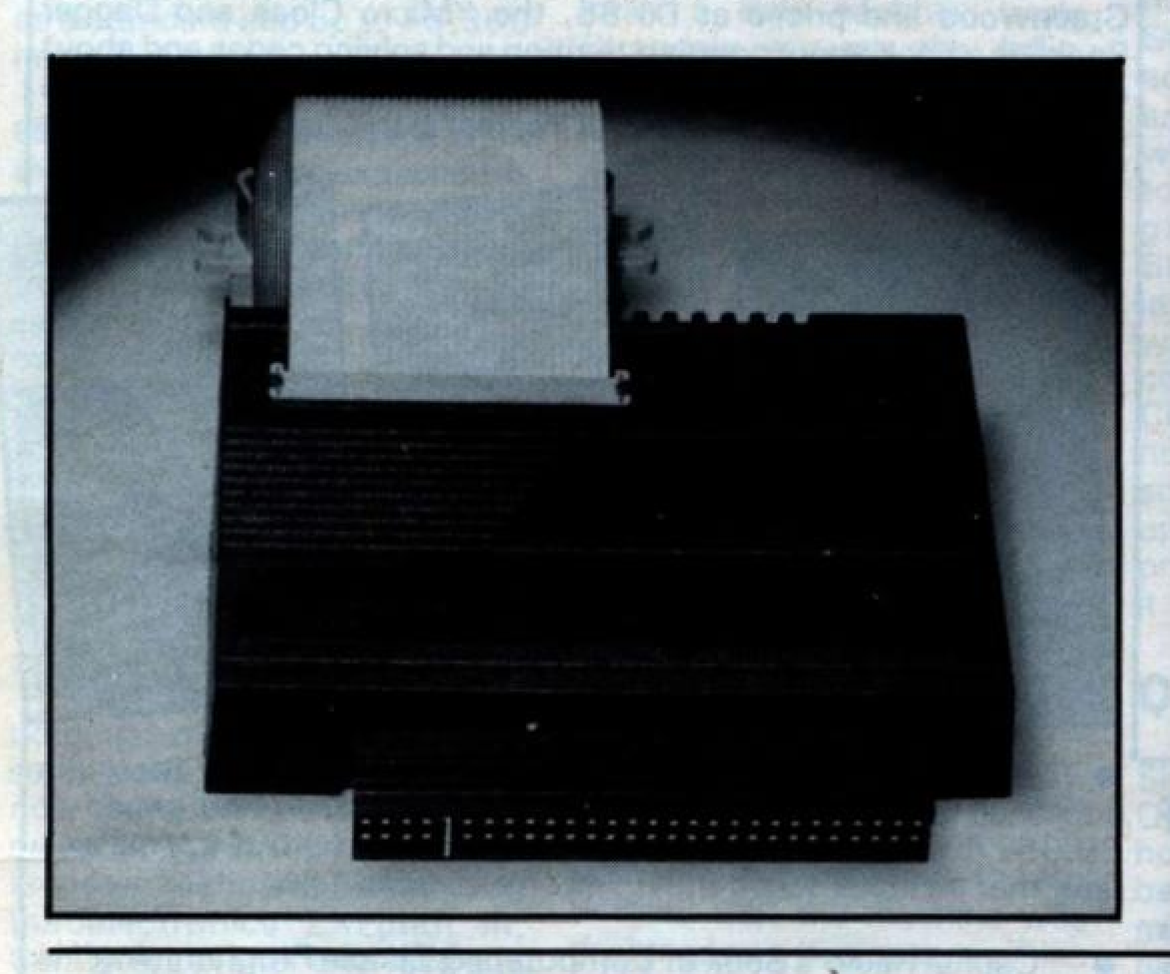
Kempston Grand Prix

Two new joysticks from Kempston, the Formula 1 is based on the Pro 5000 model but has the switches changed to micro switches and has been moulded in the colours of the Kempston racing team, as has the Formula 2, which is in the pistol grip style with buttons on both the base and the top of the stick.

Their new model of joystick interface retains their 'Kempston' standard mode of operation but has rehoused in a case more fitting to the Spectrum + style. Complementing this is their 'Pro' joystick interface which has three sockets and provides for the Kempston, Sinclair or cursor keys control, which makes it a very versatile device. Also applied is a ROM cartridge port for the rather rare cartridges that were supposed to take the game playing world by storm.

And finally, rehoused in a Spectrum + type case is their Centronics E interface to run one of the many full size printers. They claim it is compatible with most other interfaces such as disk, micronet and interface 1. Although their publicity department sent five press packs on these items, not one of them mentioned a price!





Microframe gives a little bit more

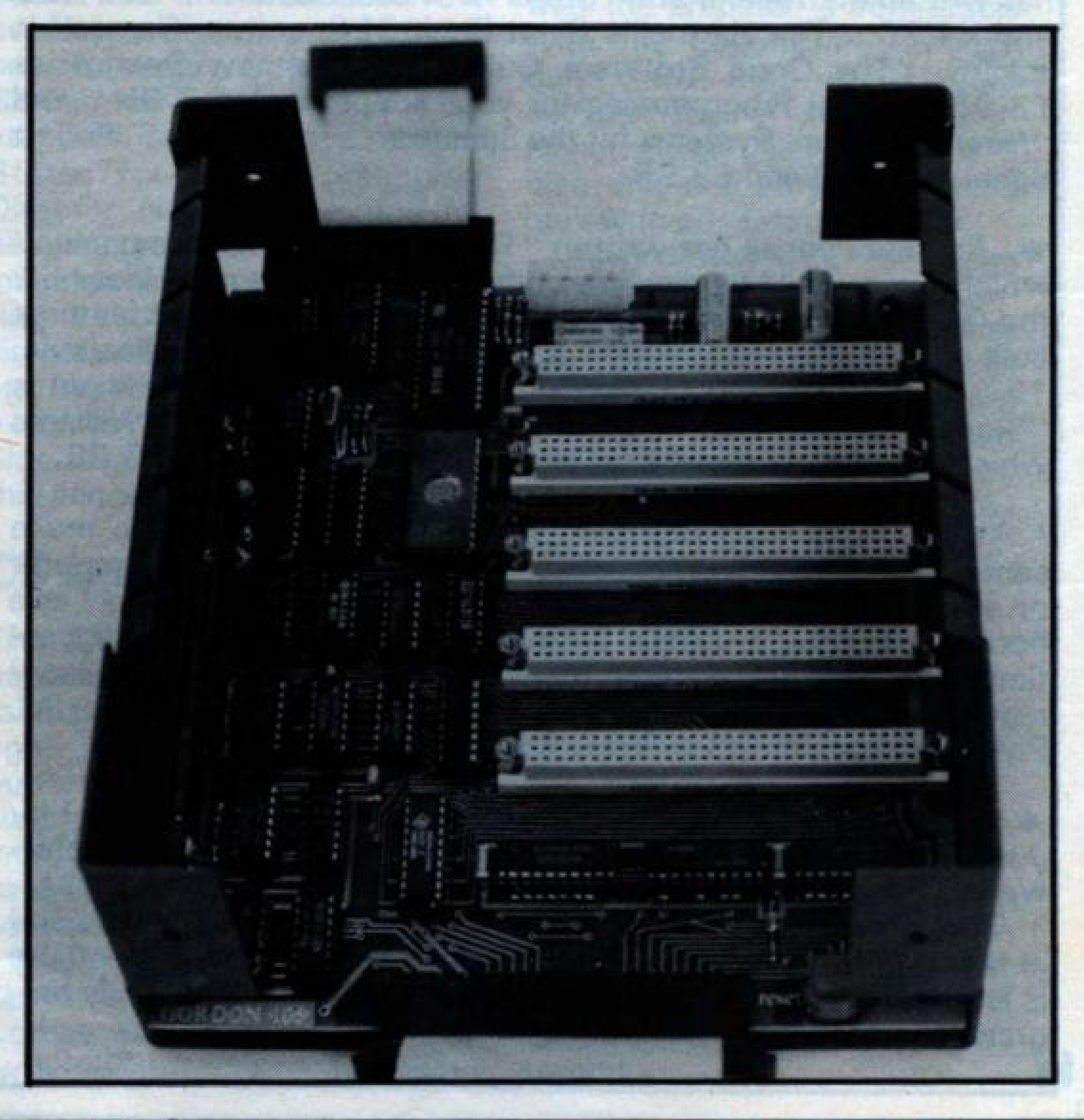
Gordon Micro Ltd. has just announced their Microframe. Apparently, it not only has a floppy disc controller interface for use in any model of the Spectrum, but because of its five slot motherboard, they say it's a micro-sized version of the Mainframe Computer, allowing the serious user the opportunity to learn and experiment with real computer applications.

The floppy disc interface, after a reset and a RUN command, automatically, through the on-board PROM, calls the file "SYSTEM" and loads the disc operating system (DOS) into the on-board 16K RAM, which has the same address location as the BASIC ROM which means that no register or memory are used on the Spectrum.

The DOS seems very comprehensive and supports the commands "Load", "Save", "Merge", "Open", "Close", "Catalogue", "Format", and "Erase". The system used in the DOS is logical and simple, ie Load D1 "name". The commands are programmable and the "name" can be a variable assigned during the run of the program.

Because the Microframe has a soft operating system, each of the interface cards shortly to be announced by Gordon Micro, such as RS232 — Centronics Parallel, Input/Output Ports, Digital to Analogue Convertirs, Robotics, Bar Code Reader and Joystick Controller will have basic statements directly programmable to operate them.

They are keen to promote the educational value of the Microframe and cards, therefore with each of the modules, documentation is given explaining the circuits and the software used. For further information, contact: Gordon Micro Ltd., 3 Callendar Road, Heathfield Industrial Estate, Ayr KA8 9DJ. Tel: (0292) 280467.



1.44 MB disk system for QL

Micro Peripherals Ltd have produced a 3.5 inch floppy disk drive system to operate with the Sinclair QL.

The system which has been designed and manufactured in the UK with cost in mind is available in three separate units which can be purchased individually. These are an interface module, first and second disk drives. Each drive is housed in a rigid black textured steel case. The two Drive system has a total formatted capacity of 1.44MB and provides fast file handling using the multitasking feature of the QL. The interface which supports up to four drives on a standard multibus provides a whole host of resident utilities including a screen editor, job control as well as additional file handling commands.

With its ease of installation the disk drive system makes an ideal compliment to the QL's powerful 68008 processor and is suited to small business and mass storage applications. The interface module has an RRP of £99 and the first and second Disk Drives are available for £189 and £159 respectively (all prices ex VAT). Micro Peripherals Ltd, Intec Unit 3, Hassocks Wood, Wade Road, Basingstoke, Hants. RG24 0NE.





The year of the robots?

As prices drop and technology advances many people are becoming more interested in the application of the computer to robotics. Intergalactic Robots Ltd (IGR) have produced a versatile device which sells for £79.95 in kit form, £99.95 fully built or £129.9 inclusive of Sinclair's Logo program. The latter in particular seems a very good deal.

Apart from the great fun this area of computing opens up there are many practical and educational dimensions which could be explored, for instance IGR suggests it could be used to play with the cat(?).

Now, regular readers may have noticed that my moggie has not been mentioned for the last couple of issues, this is because after the last encounter with a computer when he was nearly electrocuted every time the power went on, he avoids it whenever he can. Still I'll ask IGR for a loan of one of these Zero 2 robots and let you know what it does for the Spectrum/Feline relationship. IGR, Unit 208, Highbury Workshop, 22 Highbury Grove, London N5.



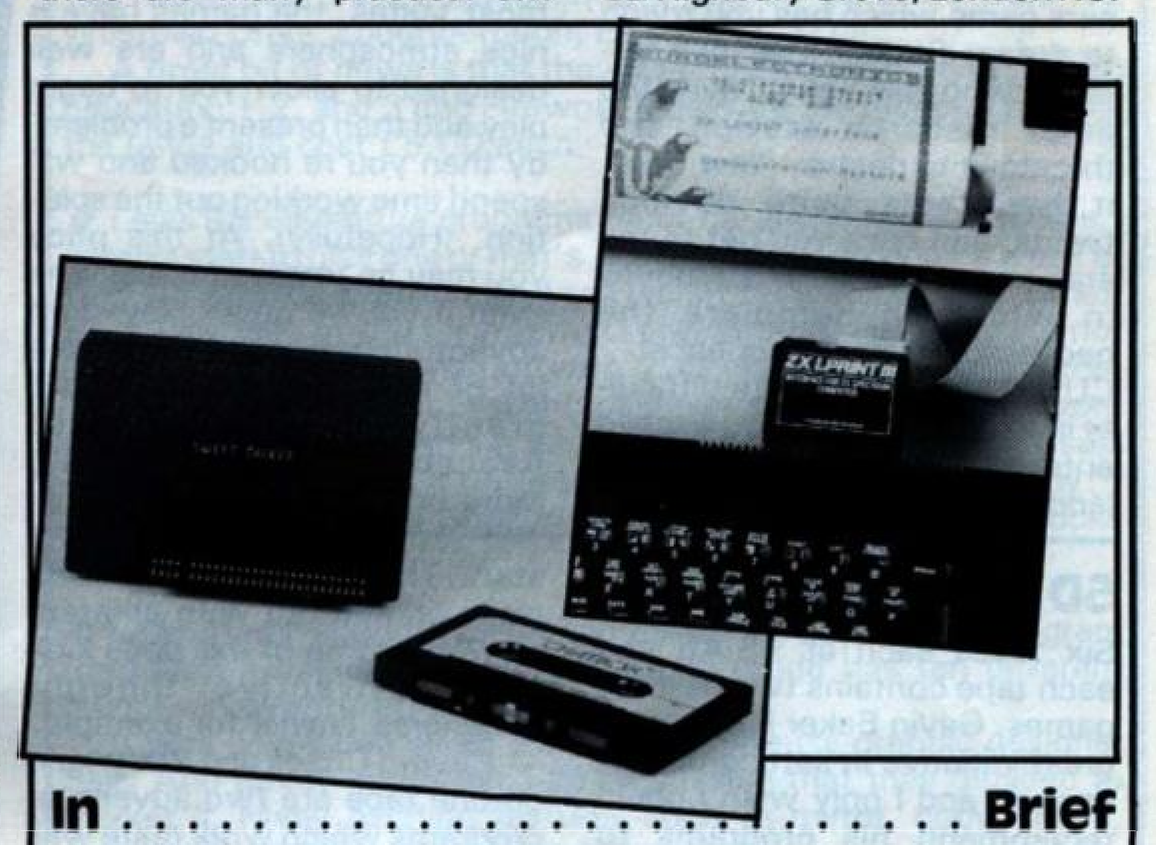
Data Deutche

From Germany and marketed by Twillstar Computers, (17 Regina Road, Southall, Middlesex) comes a large impressive looking cassette data recorder.

The unit stands upright and Twillstar claim that it has a precision tape drive and was designed specifically as a computer recorder to make it more reliable.

Manufactured by the Walton Electronics plant in Munich and given the title MC3810 it features a tape counter and a series of lamps to indicate the various functions. It is also claimed that the head is easily adjustable from the outside, an important feature which is important yet all too frequently omitted.

I would have liked to have commented on how it performed and indeed, Twillstar very kindly sent one along, unfortunately the mains adaptor was a two pin round one and incompatible with our three pin-square sockets, the instructions were in German and I did not like the look of a sentence that begain "Achtung. . ." The cost is £25.95 + £3.95 for cables + £4.95 for the PSU.



In . . . . Brief

- Turn your ZX81 into a robot with Maplin's "Trundle" package, on sale for only £49.95 (not including a ZX81). Contact them at PO Box 3, Rayleigh, Essex SS6 8LR.
- Full colour screen dumps can now be printed on the Seikosha GP700 or the Epson JX80, and four colour dumps on the CGP115 and the MCP40, thanks to the latest version of the Euroelectronics ZXLprint III.

The software is included in an onboard Eprom and it still costs £34.95 + £9.95 for a cable. I use this interface to produce the listings for ZXC and have nothing but praise for it and the company. They can be contacted at 26 Clarence Square, Cheltenham, Glos.

- Chaos was caused over the suppliers of the Slomo device which we reported on recently, however all is now clear and it is being marketed by Nidd Valley Micro Products Ltd., Stepping Stones House, Thistle Hill, Knaresborough, N. Yorkshire at £14.95 and a super, useful little device it is too!

BUDGET SOFTWARE

Lately the market has seen an increase in the amount of software available in the £1.75/£3.50 range and I thought we'd take a closer look this month.

Games Without Frontiers 8th Day Software

There are six programs available from this company at the moment, all text adventure games and all produced using the Quill adventure writing program. Although they have been out for a while now, testing and reviewing adventure games tends to take longer than arcade games.

The set is very well presented and each program has a difficulty level given so you can go straight to the more complex if you are a hardened adventurer or ease in gently if not. The topics are varied and interesting and, to give them briefly are:

ICE STATION ZERO — a beginners game which has you trying to defeat Stirling, the mad terrorist who has taken over the polar research station and threatens to destroy New York. It has some quite devious twists, and once you get to the station you only have 30 moves in which to complete the necessary tasks in sequence!

CUDDLES — moderate difficulty in which you are a young child entering the rather unfriendly land of make believe. Cliff said I should try this one as I'm in my second childhood already!

QUANN TULLA — a moderate difficulty space adventure where your task is to save the universe from the Empire. I spent ages on this one, I solved the initial problems easily enough but then couldn't find the cupboard key even with the aid of the Hint Sheet. Frustrating.

IN SEARCH OF ANGELS — again moderate difficulty but with a "James Bond" type theme.

FAERIE — is an advanced difficulty game which they describe as a "surrealistic fantasy", Titania, Cyclops and a Snowman are among the cast of characters.

FOUR MINUTES TO MIDNIGHT — also advanced level, sets you as one of the 10% of the survivors of a bacterial holocaust. Here you don't save civilisation, you rebuild it.

A great selection to cover most tastes, the games have a nice atmosphere and are well designed to allow you to begin play and then present a problem, by then you're hooked and will spend time working out the solution. (Hopefully). At this price you may be tempted to buy one even if you've never played an adventure before and I'm sure a lot of new fans will be won, greatly recommended. Available from 18 Flaxhill, Moreton, Wirral L46 7UH.

Atlantis Software

This company has two ranges of games available, their normal products at £1.99 which include "Eights", a card game favourably reviewed by Clive Smith, and the new £2.99 "Atlantis Gold" programs.

As we go to press there are two in the latter category, Nicotine Nightmare and Self Destruct which are arcade type programs with elements of the chase and jump programs. They are fair games, the graphics are not bad, rather like early Spectrum games and movement is a little jerky. This is probably a result of the fact that they were compiled from BASIC to machine code Using the Mcoder from PSS. This is not bad in itself, but to get professional graphics you need separate user-written routines.

Good games which would have been excellent value at the £1.99 price and, though lacking sophistication, are fun.

El Dorado is their adventure game in which you are trying to re-establish Inti as one of the Inca Gods. This is quite complex and interesting and one to collect if you are into adventures or one to try if you are not. This one is priced at £1.99. Atlantis Software, 18 Prebend Street, London N1 8PF.



5D Software

Six tapes each at £3.45 and each tape contains two or three games. Gavin Baker has shown great initiative in setting up this venture and I only wish I could recommend his programs to you.

The fact is that they are not very good, they all seem to be based on other games, although quite ingeniously disguised, and are either written in BASIC (not very successful for arcade games) or compiled by the PSS program which produces the problems we mentioned with the Atlantis games.

Also, they suffer from irritating flaws, in PAINTCRAZE for instance, if you are caught at the paint pot then you have no way of avoiding the monster when your subsequent lives start. The inserts are commercially printed but with amateur artwork, some of this does look quite attractive though, Racehorse Trainer for example.

Cavern Chaos and Ptarmigan on one tape are two adventure programs which work quite well and in my opinion are the best of the bunch, mainly because adventure games are reasonably acceptable in BASIC. Weed Attack, Electron, Wash 'n' Slosh are the main titles of the other three separate tapes. All these games are of about the standard of listings which are printed in BASIC in most mags.

As I said, I admire the attempt but really you ought to take the time to learn machine code, don't take the admiration of friends and relatives too seriously and look at the competition from companies like Mastertronic before rushing into the cut throat, competitive world of commercial software.

Gavin Barker, 12 Fleming Field, Shotton Colliery, Co. Durham DH6 2JF.

Finders Keepers Mastertronic (1.99)

Having mentioned Mastertronic it is nice to be able to give the thumbs up to their latest release. When they began they suffered from much the same problems as does 5D but they have listened, learned and succeeded.

This game is a beautifully produced graphic maze game, the animation is smooth and colourful, and in play it is quite addictive. You, as a knight of the Polygon table must search and find as many treasures as you can, an unusual feature is that some creatures will trade with you rather than simply attempt to destroy you.

At the price they sell at I would wholeheartedly recommend that you add this one to your collection.

Soft aid

Computer people have always impressed me as being the most pleasant and cheerful that I have met. There are a few exceptions I admit, but in general that goes for the users, the manufacturers and the media.

It was only to be expected really that when someone came up with the idea to do with software what Bob Geldof did for music in aid of Ethiopia then the response would be overwhelming.

Soft Aid is the title of the compilation of programs from most of the major software houses which have been donated for this project. And every program on it has been a best seller. In fact, the response was so great that several companies could not get their programs included, and these are acknowledged on the insert. However the games from those who did get their programs used make this the best collections of programs ever to be marketed.

For £4.99 (in many cases this is less that the original price of the individual games on this tape), you get Spellbound from Beyond, Starbike from The Edge, Kokotoni Wilf from Elite, The Pyramid from Fantasy, Horace Goes Skiing from Melbourne House, Gilligan's Gold from Ocean, Ant Attack from Quicksilva, 3D Tank Dual from Real Time, Jack and the Beanstalk from Thor and Sorcery from Virgin. Plus the hit single recorded by Band Aid.

Out of every tape sold £3.00 goes to the fund, the rest is used to cover basic production and distribution costs. So if you haven't got it by now, go get it and get a superb collection and help those less fortunate than ourselves. And if you pirate it then may your Spectrum wither!

Go for Gold

British Telecom leaves the realms of budget software with the launch of their "Gold Edition" range of programs. These sell at the more normal price of £5.95 for the graphically excellent Buggy Blast and the top priced and challenging Gyron at £9.95.

Gyron is a 3D maze game which requires both strategy and arcade reactions to succeed. Two programs are supplied on the cassette, a beginners game and the "real" game. With each copy of the game there is a free entry form to allow you to take part in their competition, each entrant who sends the correct solution will gain a place in a tournament to find the overall winner. And what does the winner get? Nothing less than a Porsche 924 (One owner, ex-software house programmer — not really, only joking) or its cash equivalent. Can't be bad!



Activision action

With their stated aim of being the leading software house of 1985, Activision have a whole new range of programs released or about to be released.

Ghostbusters must be their most spectacular success so far and it will be interesting to see if any of their subsequent games will match its success.

The Music Studio is an ambitious program which uses the limited sound features of the Spectrum to create music. As it was initially planned on the C64, Amstrad and MSX machines it will be interesting to see whether it manages the conversion.

Great European Road Race requires the skills involved in driving in a rally and could be a hit among fans of this kind of game. For fans of their programs, Activision are running their own software club, membership of which is free. The main business is, of course, to advertise and sell their games, however the last issue contained 16 colour pages and also contained news, articles and reviews. Anyone who wishes to join the club should write or phone Activision at 15 Harley House, Marylebone Road, London NW1, Tel 01-486 7588.

In . . . . Brief

● From Collins publishers comes the Collins Gem Revision Software, there are four sets of their established revision booklets complete with a question and answer type computer tape which consists of nine independent programs. Suggested for CSE, O level and the new 16+ exams the subjects covered are Physics, Biology, Chemistry and of course, Computer Studies. Each pack costs £8.95 and is available from most larger stores.

● Leonardo is the program which should put the spark into the Creative Sparks products. It is a graphics package which appears to provide sophisticated drawing capabilities for the Spectrum. Aimed at programmers, artists, draughtsmen and doodlers, it consists of the drawing package and a user program to allow you to actually make use of your creations.

Priced at £9.95 we'll get Colin Christmas to give it an in depth review as soon as we get a copy. Available from good computer shops.

● All four of the Psion QL programs have been modified and improved, if you get a QL now make sure the version supplied is the 2.0 set. Existing owners who have forked out to be members of the QL club get it, but if you haven't then it'll cost you.

● More revision software from Megacycal Software Ltd. All are good study aids and the titles are Images (ray construction diagrams) DC (current electricity), Motion (velocity and acceleration) and Revise Physics.

I haven't got a price list but the company is at PO Box 6, Birkenhead, Merseyside L43 6XH. I have sent them to Mike Edmunds for a review along with the Collins programs.

● Even more Educational programs! Two tapes from Software Cottage each with two programs on a musical note. Firework Music and Water Music provide drill and practice exercises and Jumpy Snake Blues and Honkey-Tonk are game based activities. The cassettes are £6.95 each and can be obtained from 19 Westfield Drive, Loughborough, Leics LE11 3QJ.

A great bit of news is that they also do ZX81 programs, Music Education 1,2, and 3 and Firework Music are the four programs in the range and cost £5.00 each.

● Level 9's adventure programs must be among my favourites, i daren't start to play one or that's the end of my work for a week or two! (It could be even longer, I still haven't solved Lords Of Time). So, it was with mixed feelngs that I saw Emerald Isle released, not only with 230 locations but with 230 graphic illustrations too. They assure me that it is slightly simpler than their other adventures and because of this it sells at £6.95 instead of their usual £9.95 price. Oh well, if this issue is late then you'll know why.

Level 9 are at 229 Hughenden Road, High Wycombe, Bucks HP13 5PG.

● Light Magic sounds like an impressive art and design program from New Generation Software, brush mode has ten different brushes in twenty different sizes!

It was developed as an aid to their in-house graphic designer Sally Ann Batley and proved so impressive that they decided to market it. Many exciting features such as mirror, copy, move, enlarge, fill and rotate, are also included.

It is available from the company at The Brooklands, 15 Sunnybank, Lyncombe Vale, Bath BA2 4NA and will set you back £14.95.

● Mirrorsoft continue to keep up their output of a variety of programs, Phineas Frog, Secret Agent is described as an arcade adventure, Ancient Quests is a two-game pack which puts you in the pyramids and in Dracula's castle, and Caesar's Travels is descibed as a "unique animated interactive program/storybook pack". Sounds fascinating.

Star Seeker is a planet, star and constellation simulation program. The first three cost £7.95 and the last is priced at £9.95.

● Highsoft announced recently that their acclaimed Highsoft C compiler is to be sold retail and should be available from most discerning software shops.

Look out for the game of the show Supergran, will it do for Tynesoft what the song did for Billy Connolly?

● We look forward to receiving a review copy of Cauldron from Palace Software, the screen shots look first rate. They are at 275 Pentonville Road, London, N1 9NL and the game costs £7.99.

● We keep getting press releases for The Rocky Horror Show program but so far it has failed to materialise, it had better be good after all this delay! CRL describe it as a fully animated graphic adventure and guaranteed non-sexist.

● Minder is complete and DK'Tronics tell us they're only waiting Thames TV's approval, hopefully they will have it before this gets on the shelves of your local newsagents.

● With the 128K of memory available Talent Computer Systems have released two text adventures for the QL. The Lost Kingdom of Zkul is a traditional sorcery game and West is set in Indian territory. Both are priced at £19.95.

GraphiQL looks like a very comprehensive graphics utility program and most of the functions you can think of are included, I say most because no matter how comprehensive it is someone is bound to think of something not included if I say "all". This one costs a massive £34.95, expensive by home computer standards but cheap by business/professional standards.

Talent are at Curran Buildings, 101 St. James Road, Glasgow G4 0NS.

● For the machine code programmer, Tomorrow's Dream Software have produced Titan. This is a machine code monitor and debugging utility and is well written, easy to use and an invaluable aid to sorting out those fatal crashes. A wide range of useful functions are provided including relocation, single stepping, string research and breakpoints.

The company hopes to branch out into arcade, adventure and strategy programs, and if they are as well written as Titan then it will be a new and exciting company to watch. Available from Richmond House, 1B Sydenham Road, Bristol BS6 5SH, Titan costs £8.00 on tape and £15.00 on microdrive cartridge.

● A load of releases from Games Workshop recently which includes Tower of Despair and its sequel Key of Hope. We received our first copy of one of their games recently and it should be featured in one of the review sections, look for Talisman. (£7.95).

Chaos is their latest and is for one to eight players. The press release looks interesting (£7.95). And finally, D Day has been converted to run on the QL, however it has also undergone a price conversion to £24.95 — if you buy an expensive machine than you can afford . . .

● Metacomco have reduced the price of their QL Assembler Development Kit to a mere £39.95, above comment applies. No address but their phone number is 0272 428781.

● Two good adventures which fans of this genre could well enjoy are Clues 'O' and Curse of the Seven Faces from Imperial Software.

Clues 'O' has many references to a certain French detective and some quite humorous messages and events. The programs are £8.95 each and should be available from your local shop, if not try Imperial House, 153 Churchill Road, Poole, Dorset.

● Simtron of 4 Clarence Drive, East Grinstead, West Sussex RH19 4RZ have produced Car Cure which is a sort of computerised fault finding manual. An interesting idea especially if you have been banished to the garage with your computer. Simtron are selling their program at £9.95.

● Stay Kool continues the trend of mispelt titles. This one is from that well respected and experienced company Bug Byte. For £6.95 you can explore over fifty locations of a spaceship in full cartoon style animated graphics. Available from most stores or Bug Byte Ltd., Mulberry House, Canning Place, Liverpool L1 8JB.

● CCS extend their already vast range by two more programs; Maverick lets you play Jackpot Draw Poker against five opponents, each with different "characters". Learn or develop your skill without risk of losing a lot of money or getting shot.

Nato Alert is a non-nuclear strategy/wargame simulation which I'm sure will find enthusiasts ready and willing to purchase. Both games are priced at £5.95 from Cases Computer Simulations Ltd, 14 Langdon Way, Blackheath, London SE3 7TL.

● Ski Star 2000 marks Richard Shepherd's debut into the arcade field. It appears to be a very flexible and unusual program in that you get a 3D skier's view as you run the course and there are 16 basic courses of which two are infinitely redesignable. The company reside at Elm House, 23-25 Elmshot Lane, Cippenham, Slough, Berks and the price of the program is £7.95.



The Incentive incentive

Well the Ket trilogy was finally won by Tom Frost aged 47 and it's great that, for a change, it wasn't a young whizz kid. Don't get me wrong, I've nothing against younger computists, it's just that we all tend to forget sometimes that people of all ages use and enjoy this technology.

Anyway, congratulations to Tom and runners up Rex Taylor and Mark Procyshyn.

Incentive's latest program is a conversion of the arcade classic Moon Cresta, now this was a particular favourite of mine in the arcades and I was rather dubious about how it would transfer. But, was I surprised! It is as close to the original as it must be possible to get, a straightforward Zap-em-all game, it will be a favourite among young arcade fans and I forecast that it will have a goodly run at the top end of the charts.

In line with the general trend of boosting sales with prizes they are offering a genuine Moon Cresta arcade machine to the first person to get a score of over 30,000. Check with them first that it hasn't been won as these offers tend to be won almost before we can print them. £6.95.

Also at the same price is Confuzion of which I have little information except "The confusion innovation — Hundreds of confuzion bombs on sixty four levels". Make of that what you will.

U.S. go for gold

The adverts for this range of programs from the states have been around for a while now but at last the games have started to emerge from the confused distribution system. Ocean have acquired most of the rights and are actively involved with Websters in the distribution of these games, the only thing now is to see whether they match up to the advance publicity.

Blue Max is a flying gme which involves dealing out death and destruction by shooting down enemy planes, bombing targets and straffing gun emplacements and tanks. Good clean family fun.

Bruce Lee pits you against various foes including a wizard and you have to dispatch them using your more human, but no less lethal, weapons of hands and feet. This features twenty locations and multiple player options. £7.95.

Yet another club to join, the US Gold Club, however this will cost you £9.95 + 75p P&P. For this you get a sweatshirt, badge, poster, membership card and discount on software.

US Gold, Unit 8, The Parkway Industrial Estate, Heneage St., Birmingham B7 4LY.

Discovery Disc Drive System

With a flourish and fanfare Opus Supplies Ltd. announced the launch of the "most advanced and comprehensive" disc drive system for the Spectrum yet.

First Impressions

This is a completely self contained unit consisting of 3.5" disc drive, interface, power supply unit which provides power for the Spectrum as well as through port, Centronics printer port, joystick port and B/W video port. An impressive set of extras indeed!

I unpacked it and was pleased to find the manual/booklet very simply written. To use the unit with virtually any Spectrum, Spectrum+, or other keyboard, all you do is plug it into the user port at the back and, in the case of the Sinclair keyboards, screw it into place with a single screw.

My first problem came in working out how to position the TV aerial lead as the case was so close and wide it covered this and all the other Spectrum sockets. The phono plug fitted to my Spectrum's lead was too bulky and I had to find a spare, but then I realized that a slight gap in the case which coincided with the cable's position was to be used and, with a bit of twisting and bending, the Spectrum and drive were connected.

Power on, an on/off switch at the back of the case was another useful extra, and all seemed to function perfectly. The system uses all the Microdrive syntax plus some abbreviations and operates in a similar fashion. This means that the use of sequential files, not feasible with some other drive systems, is possible, and another advantage is that many programs may be compatible. The disadvantage is that Interface I and the Microdrives are incompatible.



The manual explains its operation and gives some examples, I found it easy to understand and the examples were good. The joystick port is Kempston compatible and this makes it usable with a great many games.

The system is available in two formats, a single drive unit for £199.95 and a dual drive unit for £329.95. There is an upgrade drive available to convert a single drive to double drive at £139.95.

One of the problems that has held up the development of disc drive systems for the Spectrum is the marketing of such units. Opus have made an impressive start in this area by selling exclusively through the Boots chain of stores. Another limitation is the software available in this format and again Opus have had the forethought to arrange with some S/W houses to supply their programs on disc. At the time of writing there are six packs available each at £14.95 and they are:

Technician Ted/International ATC from Hewson
Mugsy/Sports Hero from Melbourne House
Codename Mat/Kentilla/Jasper from Micromega (an excellent set!)
Designers Pencil from Activision
Trans Express from Romantic Robot (a good tape to disc utility)
Mini Office from Database Publications (a good general business pack, see our full review in this issue.)

In Use

Earlier on I said that the unit may be compatible with Microdrive S/W, unfortunately nothing I had that worked with them would operate on this system. My copy of the original Trans Express on tape for tape to m/drive transfer would not even load successfully, however their specially written disc version will no doubt work as impressively as did their original, and the various programs which included options for making microdrive backup copies also failed to work.

Oh well back to hand conversions, no immediate apparent advantage to the use of microdrive syntax. Doing it this way varies between easy and impossible and my yardstick is how long it takes to convert Tasword II. This conversion was completed in fifteen minutes with a further half hour to add luxuries like a CAT and ERASE option to the menu. Easy!

There was one other problem, the manual had not instructed me to connect the Mic/Ear leads so I had to unscrew the assembly and plug them in, these were now so tight against the drive case that they kept twisting the unit out of place. I tightened the screw to hold it but a nagging worry that the thing might move and cause the port connector tracks to short out remains with me now. I consider this to be a major design fault and I got round it by adding a ribbon extender cable and not having the units connected by the screw. It is possible to obtain such a ribbon from Opus themselves, but as an optional extra, not included with the drive itself.

In operation the drives were about as fast as the other systems I'd used, about twenty seconds to load a program which normally took close to five minutes, but they operated almost silently, a great change from the strangled gurgle I'm used to. The 3.5" discs are double density 40 track and two are supplied free by Memorex who are to make and sell them.

Finally we would just like to add that any questions or problems we had with the unit were very promptly dealt with by the people at Opus, and if their sales support is as efficient as that then it is to be recommended. All in all, the unit seems to represent very good value for money, and with the distribution and software backup that they have arranged this is likely to represent a serious challenge to the other disc drives on the market.

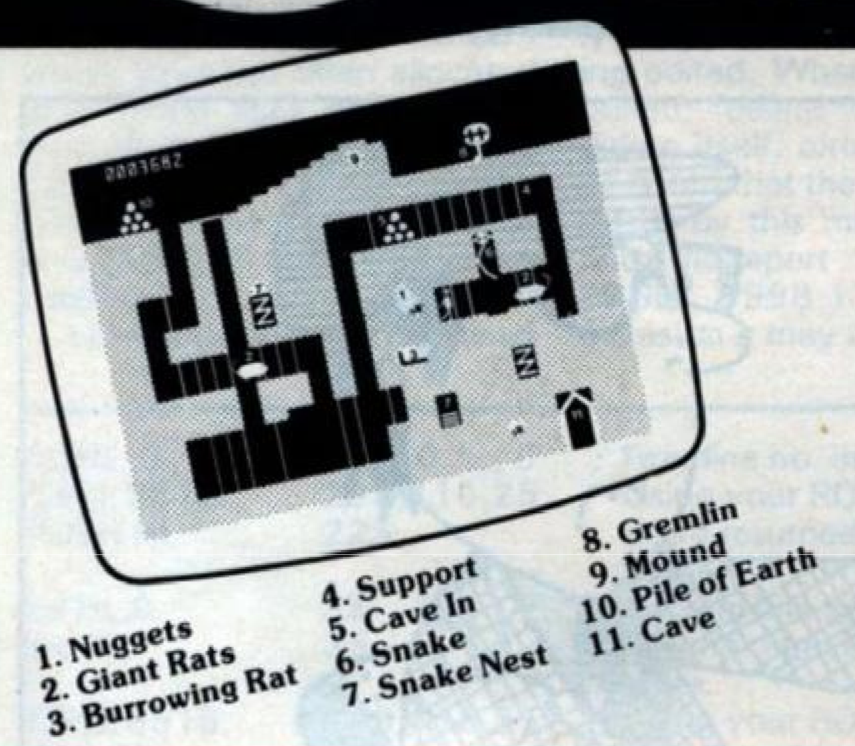
Opus can be contacted at: 55 Ormside Way, Holmethorpe Industrial Estate, Redhill, Surrey RH1 2LW.

LOOK!



NOW THERE ARE 3

HI-RES PROGRAMS FOR THE 16K ZX-81



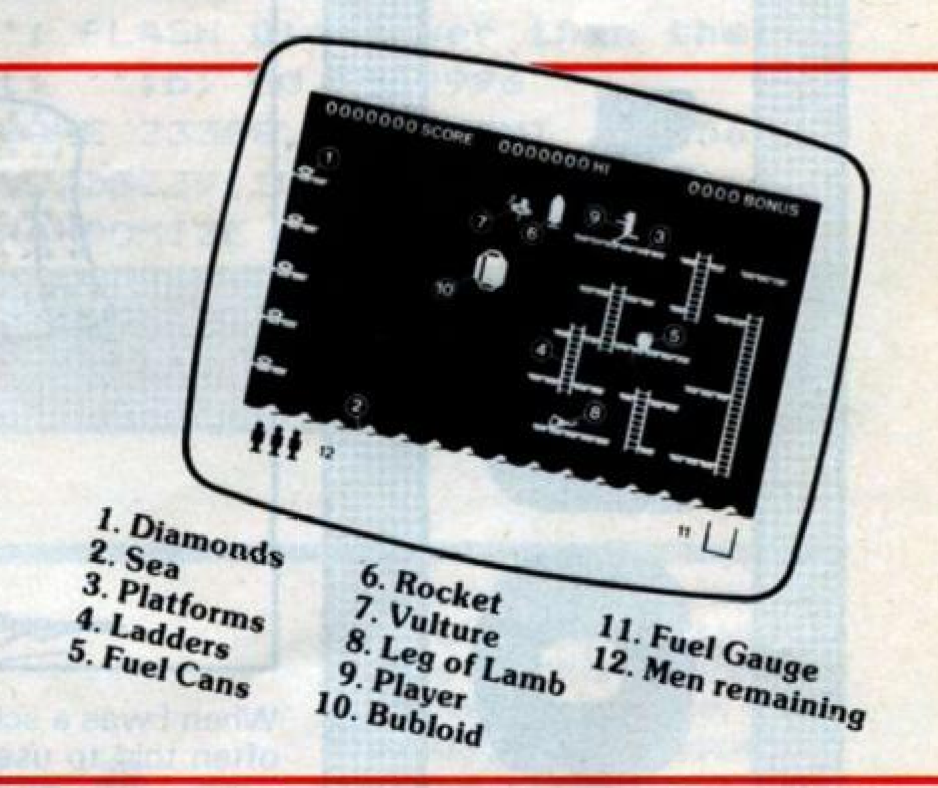
FORTY NINER

In 1849 the Great American Gold Rush started. Almost everyone who could sold up everything and dashed to the west coast to look for this precious metal – including you!

You must excavate this precious metal – but can you survive the giant rats and that vicious Gremlin which will come to infest your mine? Can you trick the snakes into leaving their comfortable nests and destroy the rats for you? Can you keep the Gremlin at bay?

Riches await you – but so do the hazards!

ROCKET MAN



Get rich quick by collecting Diamonds that are simply lying there waiting for you!

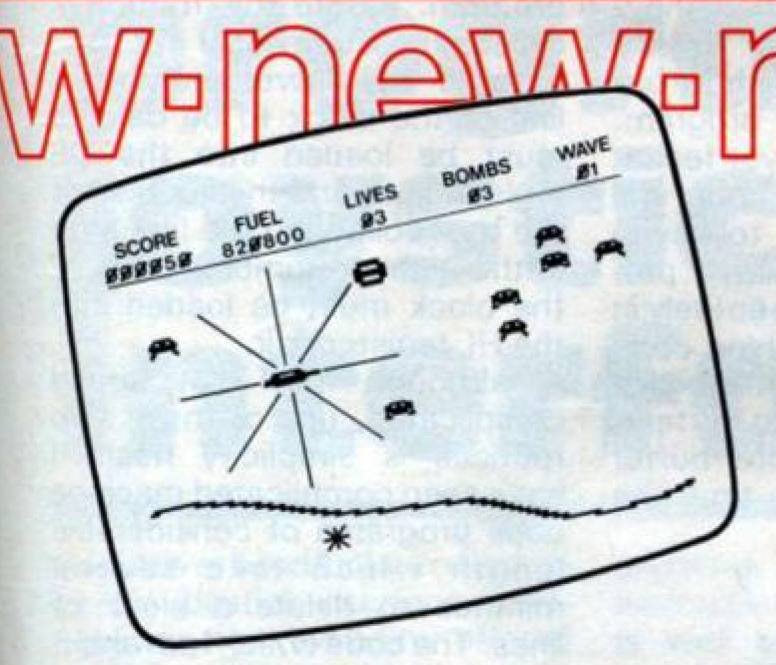
Oh . . . I forgot to mention that there are one or two problems!

There is an expanse of shark infested water between you and the Diamonds and a strange breed of Bubble that seems hell bent on getting you in it! Somehow you must cross it . . . .

You have a Rocket Pack to help you (a Vulture on higher levels) but you must rush around the platforms and ladders collecting cans of fuel (legs of lamb with the Vulture) and cursing that weird Bubble. Once you have enough fuel then it's Chocks Away!

Oh . . . but don't run out of fuel on the way – otherwise it's . . . SPLASH!

ew-new-new-new-new-ne



Z-XTRICATOR

A long time ago, in a galaxy far, far, away a terrible war took place between two hostile races. Any prisoners taken could not expect to live very long in the hands of their captors. Their only hope lay with a group of valiant warriors – the XTRICATORS – whose task it was to rescue fellow beings from the alien planet's surface. You are about to take on the role of such a warrior . . . .

Please send me:

		QTY	TOTAL AMOUNT
FORTY NINER	£5.95		
ROCKET MAN	£5.95		
Z-XTRICATOR	£5.95		
		TOTAL	

ZX

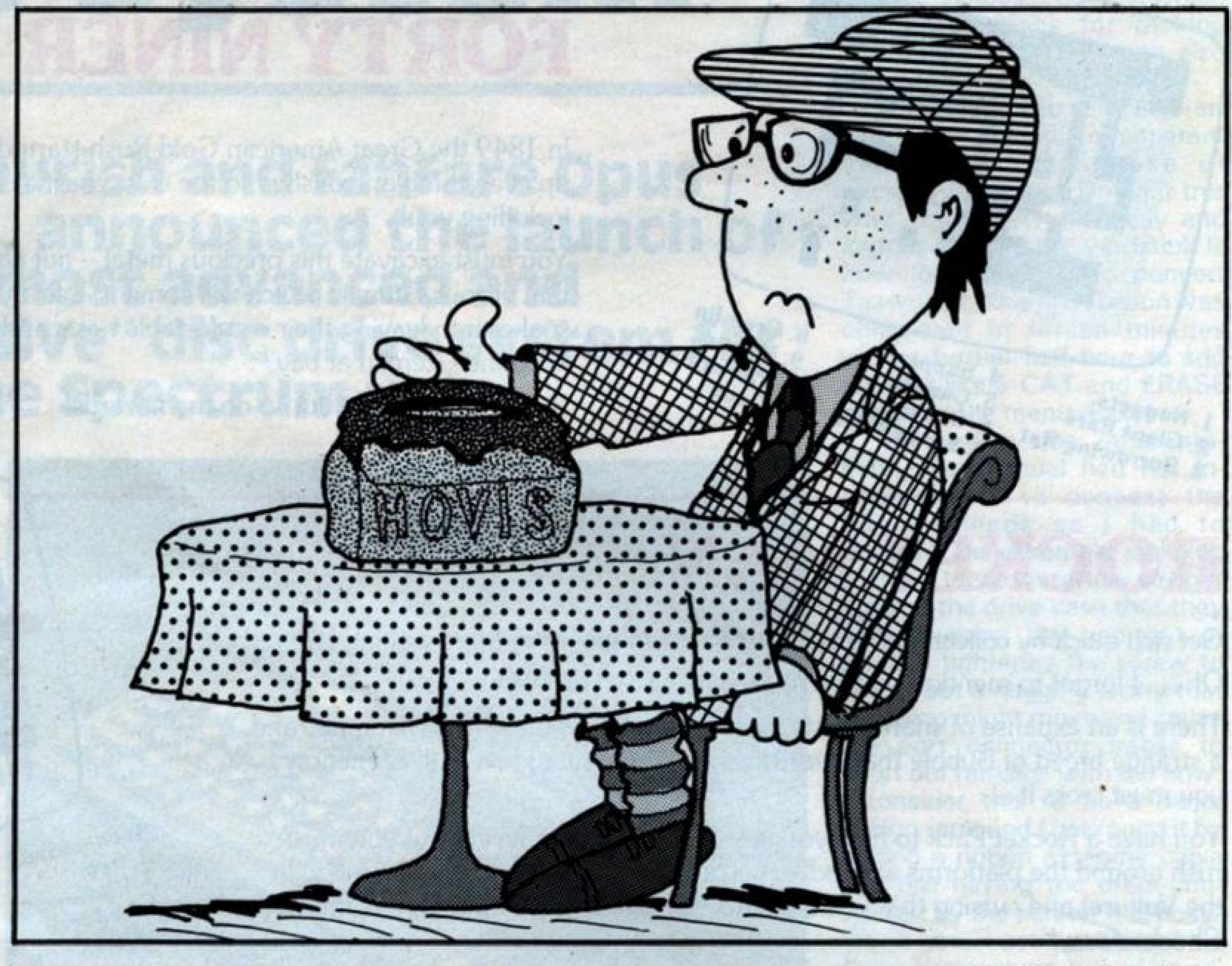
Available from all good computer shops or send cheque/P.O. for £5.95 (inc. P&P) to:

Software Farm,
FREEPOST (No stamp required) (BS3658), BS8 2YY.

Software Farm, 155 Whiteladies Road, Clifton, Bristol BS8 2RF. Telephone (0272) 731411. Telex 444742 AFMADV G

User your ROM

Norman Green in Derbyshire makes life a little easier for 16 and 48K programmers



When I was a schoolboy, I was often told to use my loaf. Any day now, I expect to hear some youngster told to use his ROM! It would be sound advice, even though not a true parallel. Using one's loaf is to use one's own brains: to use your ROM would be to make use of someone else's; and if, like me, your computer is a Spectrum, the brains you would be using are those of Uncle Clive and his team of experts at Sinclair Research. The Spectrum ROM, with over sixteen thousand bytes of permanent memory, contains many very useful subroutines just waiting to be called by some grateful user (or should I say USR?).

Although ROM can be called from the keyboard using the USR Key in instructions such as 'RAND USR 0000' or 'LET L=USR 0000', the ROM routines are at their most useful when called from machine code programs, in which the programmer can easily arrange for the entry conditions of any particular routine to be satisfied.

In this short article, I shall limit myself to discussing just two of the many routines in Spectrum ROM and then show how they may be linked together to provide a short but very powerful utility program. Readers who do not yet feel at home with machine code will nevertheless be able to key-in and use the concluding program, which is written entirely in BASIC with the machine code stored in a data line from which it will be transferred to a temporary home in the printer-buffer section of RAM each time the program is RUN.

Into the ROM

The first of the aforementioned routines is situated in the Spectrum ROM at decimal address 6510. Its function is to determine the address in RAM of the first byte in a program line whose line number has been previously entered into the HL register pair. After calling 6510, the HL register will contain the required address.

The other routine may be entered at 6629. Its function is to delete lines from the basic program. Before this routine is called, the address of the first byte in the lowest-numbered line of the block to be deleted must be loaded into the DE register pair; and the address of the byte following the last byte in the highest-numbered line of the block must be loaded into the HL register pair.

Although they may sound complicated, use of these two routines is simplicity itself. I have seen complicated machine code programs of considerable length which take several minutes to delete a block of lines. The code which I am about to offer is a mere 19 bytes long and can delete a large chunk of unwanted program in a fraction of a second. It is more straightforward than the much-used method of corrupting the length-of-line bytes in order to fool the computer into thinking a block of lines is all one single line, and then having to delete this by keying.

For those familiar with assembly language mnemonics

these are printed below, alongside the 19 bytes of decimal machine code.

Any line numbers are admissible, providing the first is not higher than the second. If the two are equal, then single line deletion is effected. If numbers which have not been allocated to program lines are entered, then all lines encompassed by the two numbers will be deleted. (This also applies to the number zero and to all numbers greater than 9999).

I conclude with the promised basic program. The lines are numbered 9990 to 9998 so that if transferred to tape by keying SAVE "delete", it may be recalled whenever required by keying MERGE "delete", when the high line-numbers are unlikely to clash with the program being edited. When no longer required, "delete" may be used to delete itself; although it should be noted that the deletion of line 9998 by this method will produce the report "C Nonsense in BASIC, 9998:1", but on this occasion it may be ignored.

Ld HL, 0	33 ,0 * ,0 * ,	First line no. into HL.
CALL 6510	205,110,25,	Using your ROM.
PUSH HL	229,	Store returned address on Stack.
Ld HL,0	33 ,0 * ,0 * ,	Second line-no. into HL.
Inc HL	35,	Line no. above deletion block.
CALL 6510	205,110,25,	Using your ROM.
POP DE	209,	Reclaim address from Stack to DE.
CALL 6629	205,229,25,	Using your ROM.
Ret	201.	Return to Basic.

* * Line numbers are poked here in usual way, least significant byte first.

Assembly Language Listing

```
9990 REM DELETIONS
9991 DATA 33,Ø,Ø,205,11Ø,25,229,
33,Ø,Ø,35,2Ø5,11Ø,25,2Ø9,2Ø5,229
,25,2Ø1
9992 RESTORE 9991: FOR n=Ø TO 18
: READ a: POKE 233ØØ+n,a: NEXT n
9993 INPUT "Enter lowest line-nu
mber in"'"block to be deleted:
";a
9994 POKE 233Ø1,a-256*INT (a/256
): POKE 233Ø2,INT (a/256)
9995 INPUT "Enter highest line-n
umber in"'"block to be deleted:
 ";b
9996 IF b<a THEN  INPUT "Re-ente
r second line-number,";' FLASH 1
;"NOT"; FLASH Ø;" lower than the
 first:  ";b: GO TO 9996
9997 POKE 233Ø8,b-256*INT (b/256
): POKE 233Ø9,INT (b/256)
9998 RANDOMIZE USR 233ØØ
```

DK'Tronics programmable joystick interface

I had never been lucky enough to own a joystick interface (sob), so when our kind editor offered me this one to review I eagerly accepted it. I started to have silly ideas about winning a game in 'Match Point', and even worse, escaping from the horrors of the 'Underwurlde'. With these promising thoughts in mind I set about discovering the relative merits of the DK'Tronics programmable joystick interface.

The £22.95 package includes the interface unit, a cassette containing the driver program, and a fairly brief set of instructions. The interface unit is well put together and fits snugly behind the spectrum via a through-ported edge connector. The joystick socket is sensibly located on top of the unit so the joystick plug does not foul on any larger add-on keyboard if fitted. The interface is compatible with interface 1 and microdrives.

Following the instructions carefully, I plugged in my joystick, flicked the little switch on top of the interface and then loaded the driver program. The program, encouragingly entitled 'Joy', loaded in about 30 seconds and auto-ran. After a further 30 seconds of key pressing I had a fully operational joystick ready to do its worst. I find that I rarely program the interface manually as it is much more complicated, and the diagonals are not programmed (i.e. you cannot fire and move at the same time).

The interface supports the autofire option found on some joysticks, but surprisingly the instructions do not mention the fact. Incidentally, make sure the autofire switch is off when programming the interface, otherwise strange things happen.

During the few weeks I have had the interface, it has always performed perfectly. Coupled with my Quickshot II joystick it proved a worthy addition to my armoury (although I still haven't beaten McEnroe and his friends in 'Match Point'). When compared to other programmable interfaces on the market, the DK'Tronics product emerges favourably. It is certainly one of the cheapest available (some non-programmable interfaces cost only a few pounds less), and reliability should be assured coming from DK'Tronics. The only real criticism is the complexity of manual programming; it is far easier to stick to using the tape.

After all those kind words, it would be very hard for me not to recommend the DK'Tronics interface to prospective purchasers. So I'm going to take the easy way out and give the thumbs up to a good product at a competitive price.

DK'Tronics, Saffron Walden, Essex.

POWERFUL AND INEXPENSIVE BUSINESS SOFTWARE FOR ZX81, T/S1000 and T/S1500 COMPUTERS

ZX-TEXT



A word processor is to a computer user what a typewriter is to a typist, except that the former has more advantages than the latter. ZX-Text can operate in 16-64K RAM providing from 1350 to 9000 words per document. It features 6 different options: write, read, edit, print, save and clear text. Text is written on a per-line basis with quick speed and with horizontal back-space and delete capabilities being available. You can also access the editor directly from write mode and vice-versa. Text can be proof-read on a per-line basis allowing for enough time to determine if any editing is needed. The text editor allows a line of text to be deleted, inserted, replaced and listed for editing. You may also change a word or expression within a line, stop or start text while it is scrolling up the screen, begin reading text from the first line of the file, re-enter write mode from the editor, return to the main-menu or create a window so that you can read-edit two files simultaneously. The print option takes text displayed in 30-column format on the screen and outputs to either the ZX/TS printer. (With Memotech's Centronics Parallel Interface 80-column and lower/higher - case output is possible.) Files may be saved on tape cassette with the use of one single command, or by the same token they can be erased from memory / storage so that the full capacity of the program can be used for other purposes such as composing letters, reports, articles, memos, standard forms, instructions, ads, graphs, telephone directory, lists of customers, members, friends...etc. Also copies of files are always less expensive and easier to run than using a photocopier. Other advantages are savings in time, paper, ink, correcting mistakes and adding afterthoughts more efficiently than doing them through either handwriting or using a typewriter.

$11.95

ZX-CALC



An electronic spreadsheet calculator is the fundamental basic tool for summarising, reporting and analyzing in matrix form any accounting, mathematical or scientific manipulation of numbers. ZX-Calc operates in 32-64K RAM and affords a maximum of 3360 characters / spreadsheet. The entire matrix consists of 15 columns (letters A-O) and 30 rows (numbers 1-30) with 8 characters / cell. Unlike other popular ESCs, ZX-Calc uses in calculations and within cells all 14 math functions on the ZX-81 / TS1000. It offers a unique *SUM function that totals one or more rows / columns simultaneously. Parenthesis can be used within equations. There is no fixed limit on how many equations may be entered. Formulas may be stored in all 420 cells of the spreadsheet. The display affords 15 rows / colums. Loading of data into more than one cell can occur across / down one or more row / column simultaneously. With vertical windowing you can arrange a set of columns in any order, or practice using fixed-variable-alignment display formats. The menu offers 6 options: enter / erase, move, calculate, print, save and clear the spreadsheet. Enter / erase allows the entering, deletion or data alignment within a cell through the use of a mobile cursor. With the move option you may move around the entire sreadsheet to access any row, column or cell. The calculate option allows you to enter labels, values or formulas into a cell or write and enter equations that will act upon the data already within the spreadsheet. You can also enter bar graphs into a cell in this option. Absolute / relative replication, down / across a column / row, is also allowed by this option. Also this option allows the automatic calculation of the entire spreadsheet with one single command. Print allows you to output to either the ZX / TS printer the entire spreadsheet by column-sets and row-pages through use of the COPY command. The entire spreadsheet may be saved on cassette tape or you may clear all data from it or erase the program from RAM entirely. The most salient advantage provided by an ESC over specifically vertical applications software is that an ESC provides a reusable framework with which you can compose any specific financial model rather than just be limited to only one statically fixed format for storing, displaying and manipulating numerical data.

$11.95

ZX-CALENDAR



Time management is an important aspect of any serious business and personal agenda. Planning how to spend our time leaves us better prepared before and while we are spending it and we remain better organized after we finish spending it. ZX-Calendar operates in 16-64K RAM affording 30 appointments in 16K, 100 in 32K, 180 in 48K or 250 in 64K. Each appointment record holds a maximum of 220 characters. The main menu includes enter, search/check/sort, change, save, clear and print any and all appointments made on a specific date or with any party. Output to either the ZX/TS printer is permissible. This program will permit you to remember to do something or to be somewhere important by cataloging your answers to six questions that you must account for in order not to waste time when it is scarce: when, with whom, at what time, for how long, where and what are you going to discuss and conclude when you get together with someone else? The program lets you permanently originate, record, classify, search, sort, calculate, modify, summarize, obtain a written report and store your answers to the preceding questions so that you will not forget what you decide to do with your time. This program identifies your time according to when you are going to spend it and with whom you are going to share it. Through these forms of labeling appointments you are able to verify or modify how your time is budgeted without wasting ink, paper or more time trying to remember what you said to yourself or what someone else said to you or where you placed certain written messages that you now can't find. With this program you will know where you can find exactly what you need to know about where you want to and have to be, or where you have been, before you get and after you got there. Thus, ZX-Calendar will let you plan your time so that you will never have to worry about what is ahead or what came before, for you will always know, by using it, to never be caught astray by any time-frame.

$11.95

$1.50 SHIPPING AND HANDLING/PROGRAM

A.F.R. SOFTWARE - 1605 Pennsylvania Avenue, No. 204 - Miami Beach, Florida 33139

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L-1 © 1984

MIND GAMES

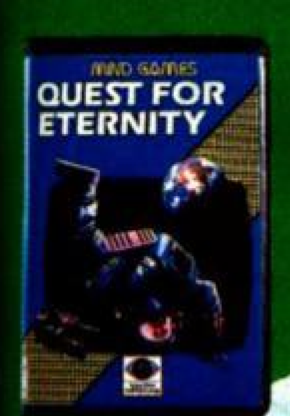
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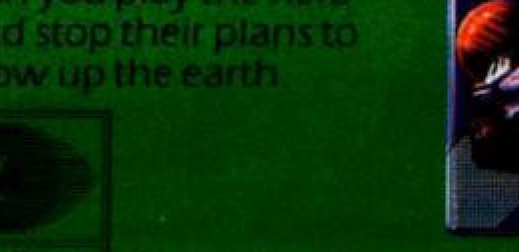
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Mathmania — Primefact

Wembley teacher R. S. Moreland invites you to have fun with numbers.

There are many programs which have been written for playing games, zapping aliens, working through an adventure trail, and the like. All of these give the player a sense of excitement based upon speed of reaction or working through a set of clues given in an adventure. There is however an area which can be just as exciting to many people, and that is 'discovery', in particular, discovering the solution to a puzzle, or a problem. Playing with numbers can be a very rewarding pastime and, who knows, one may make an important discovery in number theory.

Before computers were invented, mathematicians did all of their calculations in longhand on paper. When logarithmic and other tables were published, this made things a bit easier, but verifying and proving new mathematical propositions was still a tedious task. For example the evaluation of pi (π) to, say, a few hundred decimal places took many months of painstaking work. Again the determination of whether a number was prime could take many weeks to work out for only a six or seven digit number. A prime number is a whole number which has no factors other than 1 or itself. Try working out using only pencil or paper whether 1333 is a prime number. Simply try to divide 1333 by successive known primes up to the number which is the nearest to the square root of 1333. Time yourself to see how long it takes. Next, using the program 'PRIME FACTORS' see how the same job takes a matter of seconds.

Now for the interesting part. the program will find out whether any whole number, (integer) up to 4,294,967,295 (the limit of integer accuracy on the Spectrum) is a prime number. If it isn't, the program will give all of its prime factors. Try and invent some prime numbers and test them. If you have found a prime number which contains more than one odd digit try and re-arrange the digits to see whether the number is still prime, putting the odd digits at the end of the number of course. For example, 567323 is a prime number, but are re-arrangements of these digits still prime? Try timing how long it takes the computer to do the calculations for numbers of varying length. Also, try numbers which are the sums of a prime and different even numbers, such as 11 +6, or 11 +8, or 11 +20 etc. Is there a pattern?

Another problem to try is. . ." For a given perfect square (take a fairly large one, a calculator would be handy for this!) how many ways are there of adding two primes to make up that square? ". . . For example 25 may be made up of 2 and 23, both primes, but 36 can be made up adding 5 +31, or 7 +29, or 13 +23, or 17 +19. Can the sum of three primes make up a perfect square?

Numbers have fascinated mathematicians and laymen alike for centuries, and in particular the problem of finding a formula for generating prime numbers has occupied more man-hours than many other problems. Even today mathematicians have not yet discovered a formula for yielding *all* of the known primes. There are many formulae which will give a whole set of prime numbers, but not a general formula for all of them.

The great mathematician Euler proposed the formula $x^2 + x + 41$ for producing primes, but there are many numbers given by this formula which are not primes. Try using 'PRIME FACTORS' as a subroutine to a small program which evaluates the Euler primes from this formula. Another well known expression is that which generates Mersenne numbers (after the 17th century mathematician Marin Mersenne, a Parisian monk). This formula is $2^p - 1$ where p itself is prime. Again, write a small program to generate these numbers and test them with the program 'PRIME FACTORS'. An interesting fact is that for 200 years the Mersenne number $2^{67} - 1$ was thought to be prime; in 1903 an American professor showed that it had factors of 193, 707, 721 and 761,838,257,287.

The largest prime number found by a computer in 1952 was $2^{2281} - 1$. In 1962 the largest was $2^{4423} - 1$. In 1968 in Illinois the 23rd Mersenne prime, $2^{11213} - 1$, was discovered by using an Atlas computer. A special postmark showing this, was struck and used on envelopes for a long time afterwards. By 1971 the largest prime was $2^{19937} - 1$ discovered by Bryant Tuckerman at the IBM research centre in New York.

The method for generating prime numbers is the same one which has remained unchanged for nearly 2000 years. it was developed by Eratosthenes of Alexandria, and is called 'The Sieve of Eratosthenes'. the technique is to write down the sequence of positive integers and then to proceed systematically to cross out all composite numbers, (ie. numbers which are products of previous numbers). those which are thus sieved out will be the primes.

There are many other interesting facts about prime numbers, for example the diagram shows a 'Magic Square' of prime numbers only. If any row or column or either diagonal is added up, the sum will always be 111. Another interesting fact is that the first five digits of the decimal part of form a prime number. =3.14159....., thus 14159 is prime. Try it out on the program. Again, there is a group of numbers called 'repunit' numbers which are all repeated units. The numbers 111, 1111, 11111, are all repunits. Which of these and other repunits are primes?

Finally, here are two problems which should keep you busy for a while, and both may use the program 'PRIME FACTORS':-

Problem 1
How many 'palindrome' prime numbers can you find? A palindrome number is one which reads the same both backwards and forwards, for example 3156513.

Problem 2
Using each of the nine digits, 1, 2, 3, 4, 5, 6, 7, 8, 9 once only, form a set of three primes which have the lowest sum. Thus the primes 941, 653, 827 add up to 2,421 but this is not the smallest sum.

67	1	43
13	37	61
31	73	7




```
   10 PRINT "Program to verify th
at a number is prime"
   20 PRINT '"Type in your number
s, one at a  time as requested."
''"To stop at any stage key in s
."''"Press any key to start"
   40 DIM L(400)
   50
   60 REM *** Input module ***
   65
```

```
  70 INPUT B$: CLS
  80 INPUT "Number please        "
;N$
  90 IF N$="s" OR N$="S" THEN
      STOP
 100 LET number=VAL N$
 110 IF number-INT (number)<>0
      THEN  PRINT "Not an intege
r"      : GO TO 80
 120
 130 REM *** Initialise module *
**
 135
 140 IF number=3 OR number=2 THE
N  GO TO 290
 150 LET index=1:
      LET temp=number:
       LET flag=0
 160
 165 REM *** Mainline module ***
 166
 170 IF 2*INT (temp/2)=temp THEN
        LET L(index)=2:
         LET flag=1:
          LET index=index+1:
           LET temp=INT (temp/2)
:           GO TO 170
 180 LET factor=3
 190 IF factor*INT (temp/factor)
      =temp THEN
      LET L(index)=factor:
       LET index=index+1:
        LET flag=1:
         LET temp=INT (temp/fact
or):        GO TO 190
 210 IF factor^2>temp AND flag=0
      THEN  GO TO 290
 220 IF factor^2>temp AND flag=1
      THEN    LET L(index)=temp:
                LET index=index+1:
                 GO TO 245
 230 LET factor=factor+2:
      GO TO  190
 238
 240 REM *** Printing module ***
 242
 245 PRINT number;" is NOT prime
"'''"Its factors are:- "''
 250 FOR j=1 TO index-1
 260 PRINT L(j)
 270 NEXT j
 280 PRINT : GO TO 80
 290 PRINT " ";number;
     " IS a prime number":
      PRINT :
       GO TO 80
```

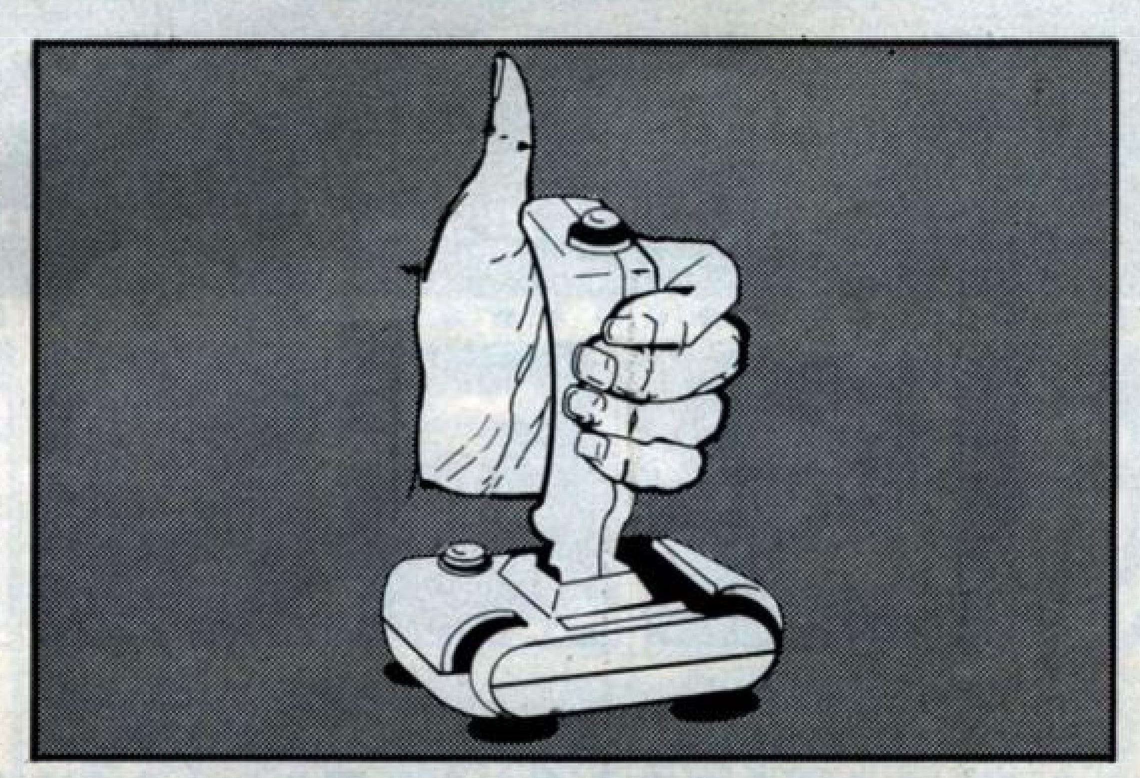
We, The Jury . . .

If you would like to have your views taken into account when we prepare our arcade reviews then send us this sheet (or a photocopy or handwritten copy) and we'll feed them all into our overworked Spectrum to get an overall assessment. We are only interested in the very latest games on the market though!

Program name: ______________________
Supplier: ______________________

Price: ______________________
Type: ______________ (zap, jump, adventure movies, etc.)
Description: ______________________

Graphics % ______________
Instructions % ______________
Difficulty % ______________



A L I E N

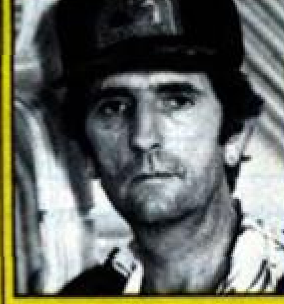


In space no one can hear you scream.









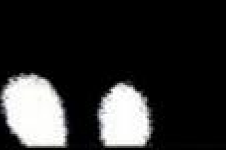

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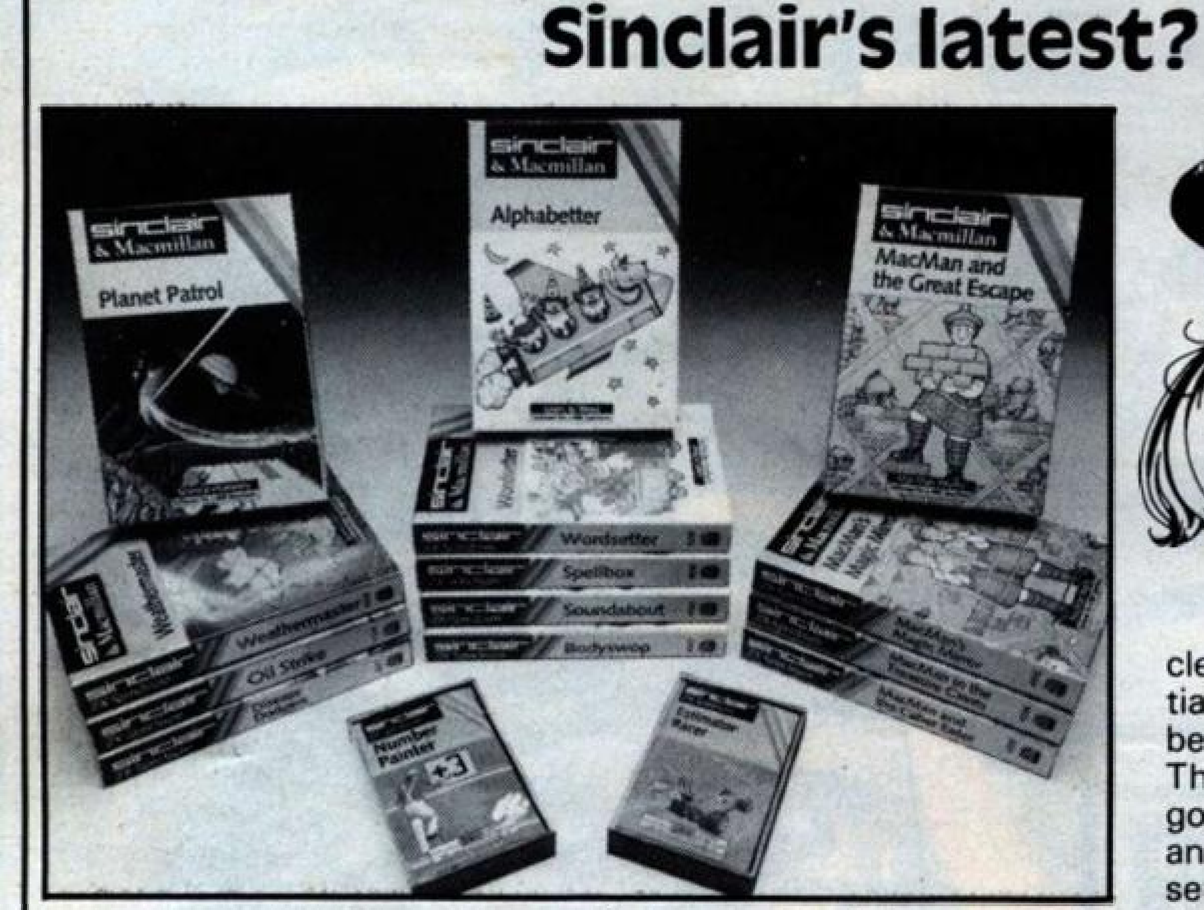


No. 1 Golden Square, London W1R 3AB, Telephone 01-437 0626



Spectrum lessons

Will Mike Edmunds administer the cane or give gold stars to Sinclair's latest?



It always seems to be a very long time between releases by Sinclair, and when they do appear they often seem like the famed curate's egg . . . . good in parts! Not so this selection, which appear to provide a wealth of educational experiences. With the exception of Number Painter and Estimator Racer, both of which bear the Psion and A.S.K. labels, all the other titles are published under the Macmillan Education banner. The loading screens however, bear the logo of Fiveways Software . . . always an indication of software of educational merit.

Each of the Macmillan titles are well presented and come with the usual comprehensive parent guide, for it must be said that the intended market is more home than school use. Having said that however, there is certainly a great deal of material that can and will be used in many classrooms. There is plenty of advice for those parents who may be unsure of the part that they can play in developing the child's reading skills. Parents are also encouraged to work through the programs with the child and to reinforce the skills gained at the keyboard with follow-up writing activities together with lots of praise an encouragement.

The guides give the general aims of the programs and outline the role of the micro in the education of children. There follows a step by step run-down of the program, and information detailing how to transfer the programs to microdrive. This last feature should be standard on all 'educational' programs this being a plea from many teachers with Spectrums in their classrooms. Perhaps now that the price of cartridges has fallen, software houses will at last make life just a little easier for all those who have to wait, and wait, while their cassettes load.

Learn to Read

There are five new programs which follow on from the Learn To Read series, these are Alphabetter, Wordsetter, Spellbox, Soundabout and Bodyswop. All have a similar format and graphical content to that found in the previous series, containing such entertaining characters as Deb the Rat, Ben the Dog and, of course, the Fat Pig.

The redefined character set is clear and easy to read, an essential for the child who is just beginning the reading process. The graphics are delightful, and good use is made of both colour and sound throughout the whole series. A recent review said that the animals are not particularly well represented but I could find no fault and the animation sequences only add to the appeal of the programs.

Briefly, Alphabetter deals with sequential alphabetical order and ordering of words according to their second letter. These programs have several speed options wich enables them to be used at various levels and with children of differing abilities. A graphic reward follows each section and the child is given a score to aim at for the next time around.

Wordsetter helps children to sort words and pictures into sets. This concept is an important stage of the learning process and there are two levels available, each of which can be played at three speeds. The program is ideally for two players, each of whom aims to be the first to complete their set or theme. A picture or word is generated at random in the middle of the screen and each child must decide if it fits into his or her set. Correct answers give the child the picture, incorrect responses take one of the pictures away. There is a healthy sense of competition and the program not only helps with sorting but also encourages accurate and rapid responses.

The next title, Spellbox, contains activities to aid word building and accuracy. There are two sections both of which are based upon the traditional games, Noughts and Crosses and Pelmanism. Although these could quite easily be played by more traditional methods, (i.e by using pencil and paper) it must be said that the instant feedback of the computer provides an additional incentive for most children. Perhaps one vital element that computers cannot provide is the warm encouragement of an adult and this aspect is strongly stressed within the notes.

Both parts of Soundabout help children to recognise and use initial sounds. Pictures shown require the child to press the appropriate letter on the keyboard, but it is a shame that programs of such overall quality take no note of the fact that the keyboard uses upper case! I suppose it might be argued that this is a deliberate attempt to match upper to lower case but an overlay would be a distinct advantage in this instance!

Bodyswop contains some very effective animation and requires the child to spell the word corresponding to the highlighted part of the featured animal. Help options are available with the required answers either displayed or hidden. Three programs introduce, reinforce and test vocabulary based upon parts of the body. The final section is more of a reward than a teaching program, and is an updated form of the 'make a Beetle' game.

Taken as a suite of programs these contain many and varied ideas and exercises which will help to introduce and reinforce the necessary skills required in an effective and appealing way.

This is a job for . . .

Maths programs are perhaps the most common type of educational software available at present so it takes something quite different to make an impact, particularly with teachers. Macmillan appear to have come up with a new idea for their latest

ventures into mathematics, just as the current trend for adventures is the 'Part one, followed by the sequel approach, and for arcade games to have successive programs based around the same character, so, now we have Macman!

Macman is the star of four programs, The Caber Eater, The Treasure Caves, The Magic Mirror and the Great Escape. In the Caber Eater, the emphasis is on Addition and Subtraction. This is achieved in several ways but essentially deals with 'find the difference' type problems and 'truth sets' or 'sentences'. The idea is that children become aware of relationships between numbers, thereby increasing skills and confidence. All of this leading to increased enjoyment.

Macman in the Treasure Caves concentrates upon subtraction and, as with The Caber Eater there are five levels of increasing difficulty. The adult can set the required level if necessary or the child can progress throughout the program at his or her own rate. Both of these programs follow a similar format, practice, reinforcement and reward. There are also Help facilities which automatically come into play when errors are made. Each of these programs include entertaining games which also provide opportunities for the child to plan strategies to maximise their scores.

Good graphics and sound together with the chubby little figure of Macman marching steadily around the screen have certainly appealed to the classes that have used these programs so far. For the pupils the mathematical content is almost an aside, but learning is most definitely taking place! The other titles in the Macman series, Macman and the Great Escape and Macman's Magic Mirror complement each other. The former deals with shape and conservation of area, whilst the latter is concerned with reflection, translation and rotation.

The Great Escape has six levels of difficulty ranging from the making of shapes with 'bricks', through estimation and conservation, to rotation, reflections and translations. I was very impressed by this program — it covers the subjects comprehensively and in a most enjoyable manner. Macman is again the star and the representations on-screen are superb, maintaining the interest of the children throughout.

The format on each level is the same — Macman is guarding a wall, behind which one or more prisoners are trying to escape. Unfortunately, holes keep appearing in the wall and it is the child's job to help Macman plug the gaps before a prisoner can escape! The number of prisoners is always on the increase and, needless to say, Macman's job becomes increasingly difficult. Watch out when one of them escapes . . . . . !

In the Magic Mirror the child needs to guide Macman to reproduce the image on the other side of a mirror. The idea is well implemented and a great deal of thinking is required on some of the higher levels to get a correct pattern before time runs out and the mirror cracks. The different levels are achieved by using different numbers of mirrors and the angles at which they are set. This program also helps with the concepts of co-ordinates, plotting and grid-work. First rate in all aspects.

The two Psion/ASK programs are not nearly as impressive in terms of packaging or length but nevertheless are equally as effective as learning aids. Each will fit into the 16K Spectrum and are more clearly recognised as games with an educational content.

These are the type of programs that make children think and who is to say that this cannot also be a hugely enjoyable process?

Number Painter sets a target number which must be made by combining numbers and mathematical operations. This follows the style of the 'platform and ladders' games that are currently so popular, and has much of their appeal in play. Four different speeds are available depending upon the character chosen, from Mr. Plod to Mr. Speedy. This is a very effective way of developing a fluency with numbers and operations.

Estimator Racer is essentially Chequered Flag with sums! The child needs to guide a chosen car along a racetrack, all the while having to estimate the answer to a displayed problem. This program encourages the essential skill of estimation and after a few runs you begin to get a real feel for numbers, the mental arithmetic that takes place is tremendous, and thankfully the choice of cars available includes a fairly slow one. Good competitive fun against others or against the computer, and fun which develops skills that are needed every day.

Science Horizons

The last four programs come under the Science Horizons heading and are simulations, of a sort. Even a review of this sort cannot do full justice to these programs, as I feel that the full potential of these demands a concentrated approach for those intending to use them in the classroom.

Oil Strike is a business simulation concerned with the search for oil. It is reminiscent in some ways of The Mary Rose (for the BBC) and gives graphical representations of test drills and rock stratas etc. There are comprehensive notes, enough to ensure that this could form the basis or be an integral part of a classroom topic for a considerable time. ●

Planet Patrol is a graphical version of Mastermind but, much, much more complex. It also stimulates logical thinking and forward planning. Put these factors together with an illustration of the solar system, relative positions, sizes and motions of the planets and you have some idea of the wealth of material available for further study. None of these four programs is immediately playable, you must take a little time to soak up the instructions and the intricacies of play. Once you are familiar with them however, they are great fun and very demanding in terms of thought!

Disease Dodgers almost stands on its own as an arcade game. It is concerned with keeping the Dodger family alive when faced with a multitude of diseases and germs. The program shows how health, diet and exercise are interrelated and also illustrates that people living in different countries of the world face different problems of health and diet. Of all the programs this perhaps is the least effective graphically, there are colour attribute problems and some of the foods represented are not clear. This aside it is very playable and should provide much 'food for thought'!

Finally, Weathermaster. This is a novel use for a computer, basic meteorology (*Nothing novel about that, have a look at Metplot, ZX October '84* — **ED**). After using this program I have no doubt that television weather forcasts will take on a new clarity. The program familiarises the user with the charts, symbols and terminology used by the media. These ideas are set in a game format with impressive results.

In conclusion I can only say that although these reviews may seem overly-enthusiastic I have been pleasantly surprised at the new levels that educational software, whether for home or school, have reached. Take two gold stars Macmillan and Sinclair! If you are somewhat skeptical about my comments, I can only suggest that you get hold of some of these new titles and see for yourself!

SINCLAIR MACMILLAN

MACMAN MATHS	SCIENCE HORIZONS	LEARN TO READ
Macman and the Caber Eater	Oil Strike	Alphabetter
Macman and the Great Escape	Disease Dodgers	Wordsetter
Macman in the Treasure Caves	Planet Patrol	Spellbox
Macman's Magic Mirror	Weathermaster	Soundabout
		Bodyswap

(All above programs for the 48K Spectrum)

Estimator Racer	Number Painter	Psion/Sinclair 16/48K

Macmillan Education Ltd, Houndmills, Basingstoke, Hants RG21 2XS.

Spectrum Arcade

David Howard tests his reactions on another batch of arcade releases

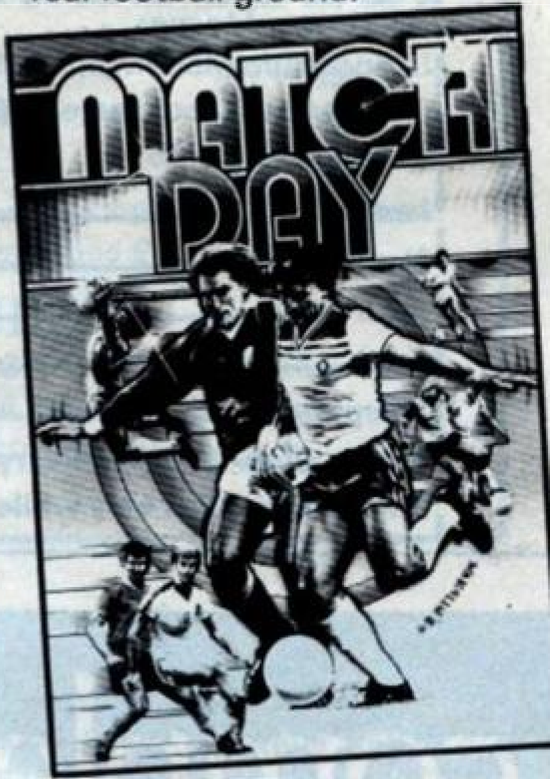
Match Day
Ocean
£7.95

You may remember WORLD CUP by ARCTIC COMPUTING, one of the first good football games on the market. MATCH DAY is far superior to any other and is of the same quality as International Soccer for the Commodore 64 — please ed, may I just mention this computer — *(No, ED!)* Obviously the graphics are not as good, but they are very clear and the problem of bleeding did not seem to occur. The ability to alter the colour of the teams is a good idea, so you can pick the one that is most pleasing to the eye and easiest to recognise.

The extensive menus at the beginning are very useful, where a number of details about the game can be changed. There is not enough space to list them all here and you more than likely would get bored, but to give you an idea it is possible to alter the names of the teams, play against the computer, a friend or in a league, alter the length of each game, choose how each player is to control his team, difficulty levels of play, and so on.

The game starts as the teams run out on the pitch, with the tune Match of the Day sounding (and no Jimmy Hill). It is a bit tedious waiting for positions to be taken, but it is at least realistic.

The whistle sounds and the game begins. Playing against the computer can be quite difficult, especially if playing on one of the harder levels (there are three levels in all — amateur, professional and international). As in most of these games, you are in control of the player nearest the ball. At times it can be difficult to gain control of the ball, especially as there is no facility to strike the opposing player, but once in control, you can pass to fellow members, dodge the other team and hopefully score. Then a kick or throw-in is taken, the direction is controlled depending on the movement of the joystick or keys, so passing to your own team should be easier than on a real football ground.



The game is ideally played with a joystick, but if you are challenging a friend it is unlikely that you will possess two joysticks, so the keyboard will just about suffice.

As with most of these games on the Spectrum, due to the limitation of sound, headaches can be obtained quite easily, but the on/off sound switch is a Godsend. The reality of the whole match, with a reflection as the ball bounces and the quality graphics make this a worthwhile buy, allowing you to play football from the comfort of your armchair.

INSTRUCTIONS	95%
PRESENTATION	90%
ADDICTABILITY	85%
VALUE FOR MONEY	85%
ZXC FACTOR	7

Ghostbusters
Activision
£9.95

Having heard the record and seen the film, you can now play the game, courtesy of Activision. This is the game everybody has been shouting about on the Commodore (not that word again) and the same scenario is present on the Spectrum version.

The game starts with you being granted a franchise to rid the city of ghouls, and to set you on your way the bank is lending the hefty sum of $10,000. Instead of retiring there and then, you have to purchase various items to help you achieve fame, fortune and rid the city of all these evil spirits.

There are three screens where you select all your equipment, from transport to the intricate ghostbusting traps. Having loaded up your vehicle, a map of the city appears and all the places that are having trouble with the fiendish ghouls flash red, and once at these haunted venues, GHOSTBUSTING can begin.

Whilst travelling around the map, if you should pass over a Roamer (a wandering ghost), he is frozen and can be vacuumed up just before you arrive at the haunted venue. After directing the Slimer (technical term for ghost) into the trap and capturing him, it's onto the next one folks, before the energy from all the ghosts gets too large or the centre spot of the city, the Temple of Zuul is reached by the Gatekeeper and Keymaster.

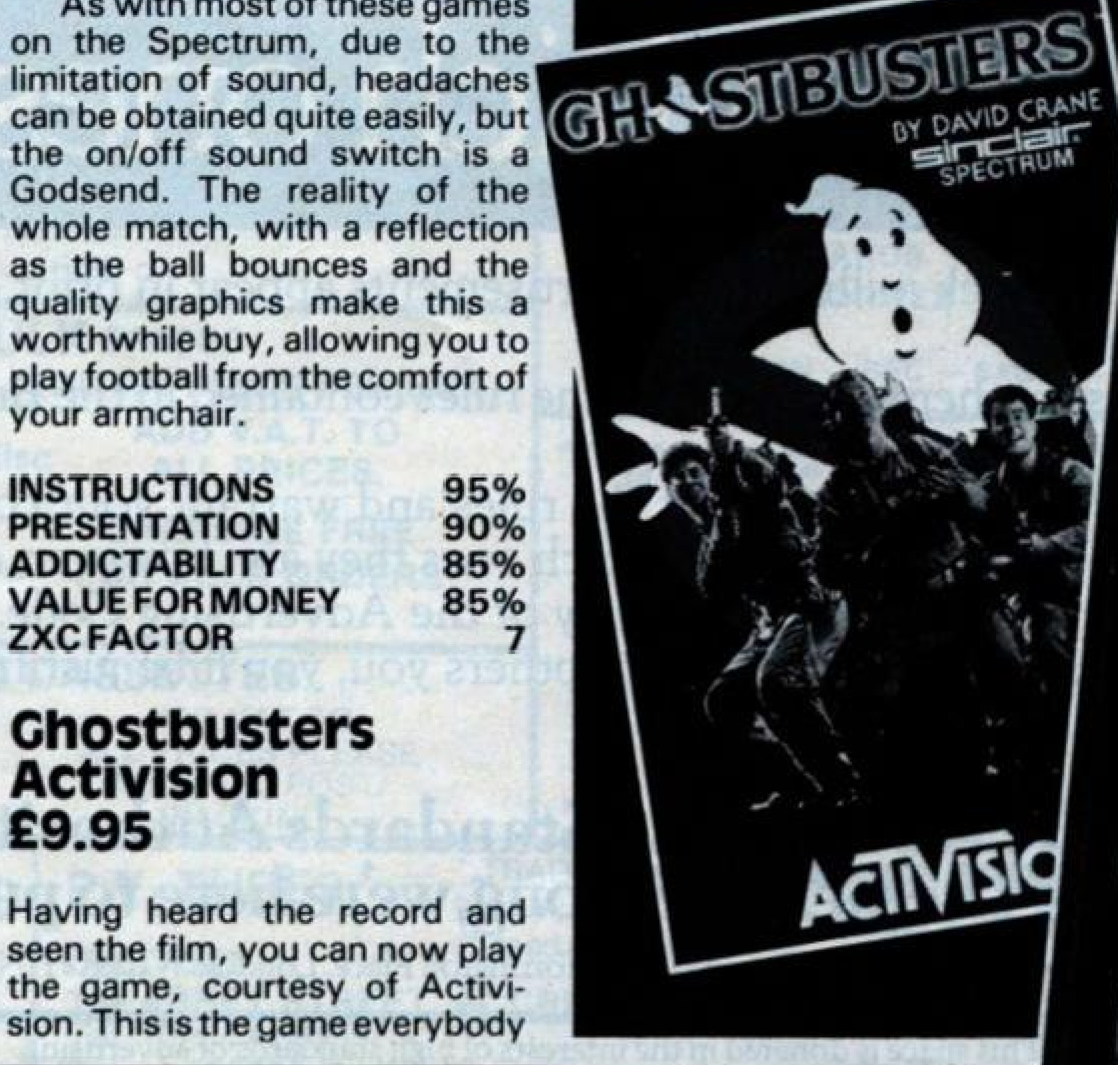
A marshmallow alert can happen at any time, where all the Roamers will quickly join forces to form the Marshmallow Man. A dollop of bait must be immediately dropped to prevent him crushing any buildings. The game will end if you can sneak two ghostbusters into the Temple of Zuul, but be prepared as this can take time while the forces of the spirit world join up to turn the city into mayhem.

Although this game does not create the same atmosphere as the film, it is quite fun to play, but I can see it at the bottom of my tape rack after a few months. Putting all this aside the speech synthesis and theme music of GHOSTBUSTERS at the beginning of the game should even put Ray Parker Junior to shame.

INSTRUCTIONS	95%
PRESENTATION	80%
ADDICTABILITY	75%
VALUE FOR MONEY	70%
ZXC FACTOR	6

Gift From The Gods
Ocean
£8.95

Ocean have delved into the depths of Greek legend and come up with an adventure game to play on your ancient Spectrum.





The game is based upon the life of Orestes. For those lesser mortals who are reading this page and do not know who this person was, I shall explain. Orestes had a mother, Clytemnestra, a father, Agamemnon and a Sister, Electra. Clytemnestra, in order to rule over Mycenae, evilly kills her husband and banishes her two childrem from the land. Electra is hidden in the catacombs below the palace, where Clytemnestra lives with her new husband Aegisthus, and Orestes, the Hero of the game, with the help of the gods must try and regain the kingdom from his mother.

You are Orestes and control your figure on screen with a joystick (virtually any) or keyboard. It is better to use a joystick as the game has an intelligent joystick facility, leaving out the need for complex combinations of keys.

In order to reclaim Mycenae, Orestes must travel around this labyrinth and collect 16 Euclidian shapes (geometric designs) and place them in the correct order around the chamber to find the exit and end of the game. Orestes has been given a sword and seven tears, which act as markers, to help him find his goal. Electra can also help in finding the shapes; she appears as an apparition and will lead you to the correct place. Scattered around are terrifying objects, placed by the Demi-gods, which will zap your strength and eventually send you to the underworld.

I enjoyed playing this game very much. The graphics are excellent, with smooth animation and although I seemed to be running around the maze doing nothing for quite some time, Gift From The Gods is totally absorbing, interesting and fun.

INSTRUCTIONS	**95%**
PRESENTATION	**90%**
ADDICTABILITY	**90%**
VALUE FOR MONEY	**95%**
ZXC FACTOR	**9**

Skool Daze
Microsphere
£6.95

Microsphere have produced a game that will not teach you to spell, as in the title, not teach obedience or good manners, but will enable you to enter a classroom where you can do what you like, and even invent names for the lengthy cast.

You are ERIC, a mischevious little brat whose school report is locked away in the staffroom safe. You have to get this report before the headmaster does, or else. In order to uncover the hidden combination, the shields that are hanging on the walls have to be hit. The masters will become disorientated by the flashing shields and will reveal part of the combination. The only problem, of course, is the history master, who cannot remember his part, so you must get his birthday out of him, and write this on the blackboard, at which point his memory will be jogged and he will reveal all.

As well as this task, you must take part in the normal activities of school, which involve going to lessons and playing. If you do not go to the correct classroom at lessontime, you will receive lines as punishment. More than 10,000 lines will end this game as Eric is suspended from the school with writer's cramp. Finding a seat during a lesson is not always as easy as it seems as they are soon taken up by other pupils. Even if you manage to find a seat, you are invariably shoved off onto the floor, gaining more lines. This school is very much like a cartoon strip, and the characters could be straight from the Beano. The graphics are fair, but not so clear although they do not really let the game down too much, as it is very enjoyable playing school, fighting the bully, using catapults and having lessons with Mt. Whithit and Mr. Creak. A must for all Non-Skolars.

INSTRUCTIONS	**90%**
PRESENTATION	**85%**
ADDICTABILITY	**85%**
VALUE FOR MONEY	**85%**
ZXC FACTOR	**8**

Pitfall II
Activision
£6.95

This is a nifty little number and is of the Arcade Adventure sort. Pitfall Harry must find his niece Rhonda, his cat, Quickclaw, and the Raj Diamond as well as gathering up all the gold along his journey. You are Pitfall Harry and travel through many scenes containing balloons, caverns and various dangers such as bats, frogs, and scorpions. You start off with 4000 points and aim for a perfect score of 199,000.

The best thing about this game is that if you happen to die along the way, you are transported back to the previous red cross, which you pass over during your mission. This means that the game is virtually endless and although your score declines when you get killed, once it reaches zero, that's it. With a lot of practice, the ideal score could perhaps be reached. As with all these games, annoying tunes are played along the way, but luckily there is an on/off button. Pitfall II is also compatible with all major joysticks.

The graphics are adequate, but I feel could be a lot better to match the standard of the rest of the game, but all in all, a good buy and stimulating.



INSTRUCTIONS	**95%**
PRESENTATION	**85%**
ADDICTABILITY	**90%**
VALUE FOR MONEY	**85%**
ZXC FACTOR	**8**

Hellfire
Melbourne House
£7.95

This is the game I have been waiting for. I have not had so much excitement in all my life. A wonderful game. Steady on you might say, have you got shares in Melbourne House? Isn't this going a bit heavy AND before the game has been properly reviewed? Perhaps, yes, but HELLFIRE is a game that requires skill, concentration and nimble fingers and is the same as a 30 year old finding out what it is like to play space invaders for the first time. There are three tasks that have been set upon you by the gods, and you must complete all three to show your worthiness.

My first task is the easiest, but requires a lot of initial thought. Once done, it appears to be quite easy. I suggest, switch off the computer, have a five minute break, and try again. It is still frustratingly difficult to. . . To what? The idea is to climb the ledges and arrive at the cave entrance. You jump from ledge to ledge avoiding the falling boulders, but one slip could quite easily see a life lost. Having completed the first task and given yourself a pat on the back, task two immediately arrives. You are in a sacred temple inside the mountain that you have just entered. Minotaurs are on guard and the idea is to reach the top right pillar to get to the next level. The fun comes when running from pillar to pillar as you are transported to another part of the temple and you have to crack the right combination to reach the exit. An added bonus was the springboard, which you can use to reach different levels.

The third and final task is to find your way through the maze and locate the exit. Your mace will kill any attacking monsters and break down the exit. The graphics in this game are faultless and so is the game.

INSTRUCTIONS	**95%**
PRESENTATION	**100%**
ADDICTABILITY	**100%**
VALUE FOR MONEY	**100%**
ZXC FACTOR	**10**

PAUL McCARTNEY'S Give my regards to

BROAD STREET

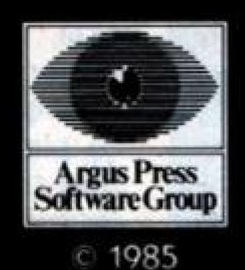
When the music stops, the mystery begins...





COMMODORE 64 – £7.99



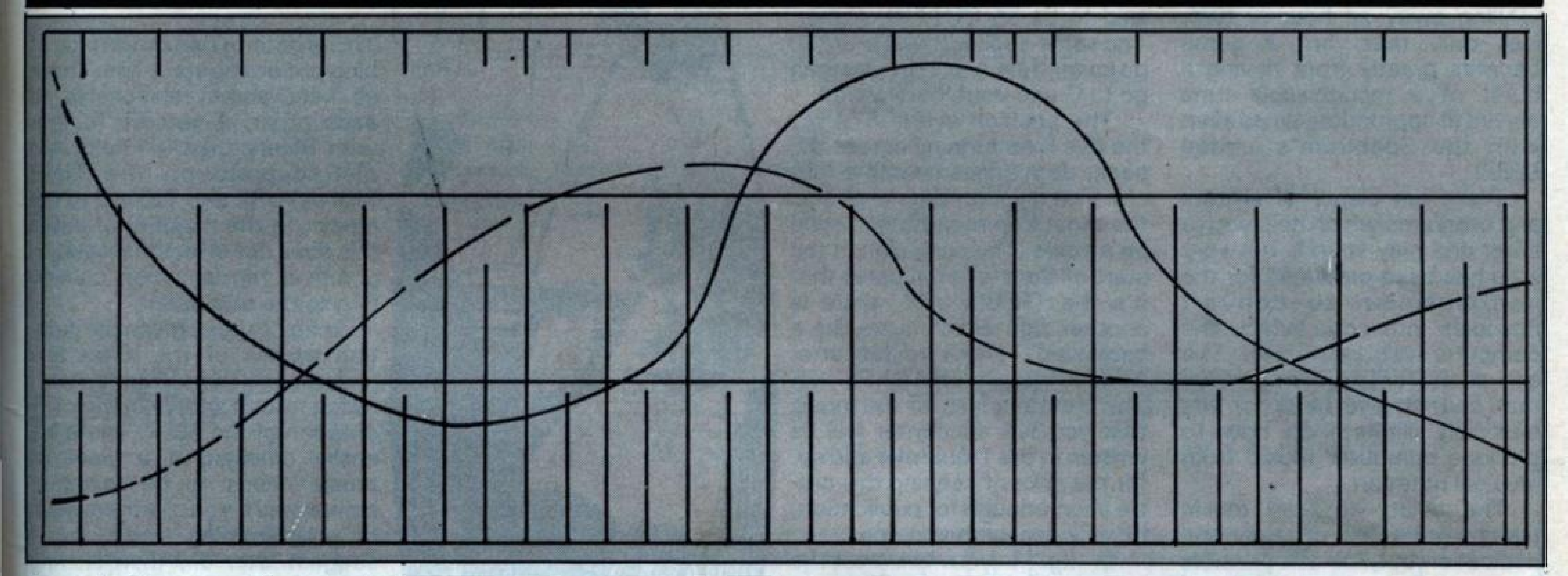


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Sounds!

We take an in-depth look at an area which is getting a lot of interest.



A couple of issues ago I reported on a visit to Electromusic Research Ltd and Mike Beacher, the owner, who make the Midi interface sold by Rose Morris. The response was fantastic, a letter flooded in, and all the way from Southend!

But seriously, this article did generate a lot of interest from all over the world and so we thought we'd have a special issue on sounds. There are several ways of creating sounds on the computer, even the ZX81 is capable, with a suitable peripheral, of sounds better than the Spectrum's unaided BEEP.

The first way . . .

With a Spectrum only, is to utilise the beep in an efficient and clever manner and, by an amazing coincidence we have a program which does this! If you have no musical ability and want to know how to go about programming music into your computer, we have an article on how to do that too!

The second way . . .

. . is to add on a sound unit, there are several for the Spectrum and even some for the ZX81, we give a round up of all these.



And finally . . .

. . approach the whole thing from the other direction, get an instrument, keyboard or synthesizer, and use your computer as a tool to create music with it.

We wondered how many readers would be interested in this rather expensive way of doing it, but two factors encouraged us, one was the amount of letters about our last item as mentioned, and the other was my personal knowledge of two young people, both at school who worked all through their holiday last year and asked for money for birthdays and Xmas so that each could buy a £635 Korg Poly-800 synthesizer.

Also, the recent appearance of the Casio CZ101, a full Midi synth for £395 and the likelyhood of even cheaper machines to follow helped us to make the final decision to present Midi in the home, an in depth look at how this system can be used by the non-professional. By the way, should any reader reach top of the pops, let us know! Meanwhile here is *ZX Computing's* contribution to the world of Culture, join the Club and Boy, won't you have a lot of fun by George!

A Spectrum spectacular of Melodic Masterpieces from Maestro Colin Christmas.

PROGRAMMING FEATURE

Well perhaps not quite so extreme, but the interest in micros and music is increasing and with a little time and effort it can be a fascinating and fun way of whiling away an hour or two. Not only that, but a game benefits greatly from having a burst of a recognisable tune played at appropriate times even with the Spectrum's limited BEEP!

There are plenty of articles and programs which help you to enter and play sounds but very little has been produced for the non-musician to convert melodies into code which the computer will recognise. The aim of this article is to remedy that and to give hints for the musically illiterate on how to produce computer music from musical notation.

The ability to read music takes a great deal of study and dedication but it is still possible for even the most musically incompetent to convert the manuscript into recognisable tunes — all you have to do is follow this guide!

Even the Spectrum manual presumes some knowledge of music and although the Spectrum + manual is a little better, I hope to explain and develop some of the assumptions which the manual makes.

First things first . . .

The Spectrum produces sounds by the BEEP command, the technical method and the use of machine code are not going to be dealt with here, but if we get enough requests then perhaps a future article?

BEEP is followed by two numbers, the first is the duration or length of time the note will sound for, and the second is the pitch or the actual note value. Let's have a look at the notes as written in script form. Put in a simplified manner, each note provides two pieces of information, the duration and the pitch — how convenient! Each note has a name, a letter of the alphabet, and these run from A to G, if you go higher than G then you start with A again but it is said to be an OCTAVE higher. The same applies if you want to go lower than A except you then go to G and work backwards.

The position in the STAVE, the five lines running across the page, determines its name (pitch). The diagram (fig. 1) shows the most common notes found on a stave. The curly sign at the start of the stave indicates that it's the TREBLE clef, there is another sign which looks like a backward C with two dots after it which indicates the BASS clef. The great majority of the music that you will encounter will be written in the Treble clef and so, for the sake of keeping this article short enough for publication, I'll only deal with this one.

In fig. 1 you will see the names of the notes and beneath them their pitch values for the Spectrum, if you have another micro then look up the value of middle C in your manual and pencil it in under the FIRST C shown, adjust the value up and down by a similar number as each note is offset on the diagram. All Spectrum users need do is look up the appropriate note and transfer the value to the SECOND of the BEEP numbers.

But, beware! Music also contains strange devices called SHARPS (#) and Flats (♭) and these can affect the pitch value. If one of these appears at the very start of the stave then all the notes of that name, no matter what octave they are, are affected. If one of these appears just before the note then only the notes of that name in that BAR are affected. Oh, and one more thing to add to the confusion, there is also a sign called a NATURAL (♮) and this cancels the effect of any sharps or flats which may have altered the value of the note previously, including those at the very beginning of the music, for the duration of the bar.

These BARs I have been talking about are not those which sell refreshment (which I'm sure you must all feel like indulging in by now), but the set of notes between any of the two vertical lines which divide up each stave as it runs across the page. The placing of these is not random, but determined by the timing of the music which again would take too long to explain in this article. So, how do these flats and sharps affect our pitch values? If a note is flattened simply subtract 1 from its value, if it is sharpened then add 1 to its value. Try to remember this as all too frequently it is the cause of some strange sounding notes in a melody!

The Duration
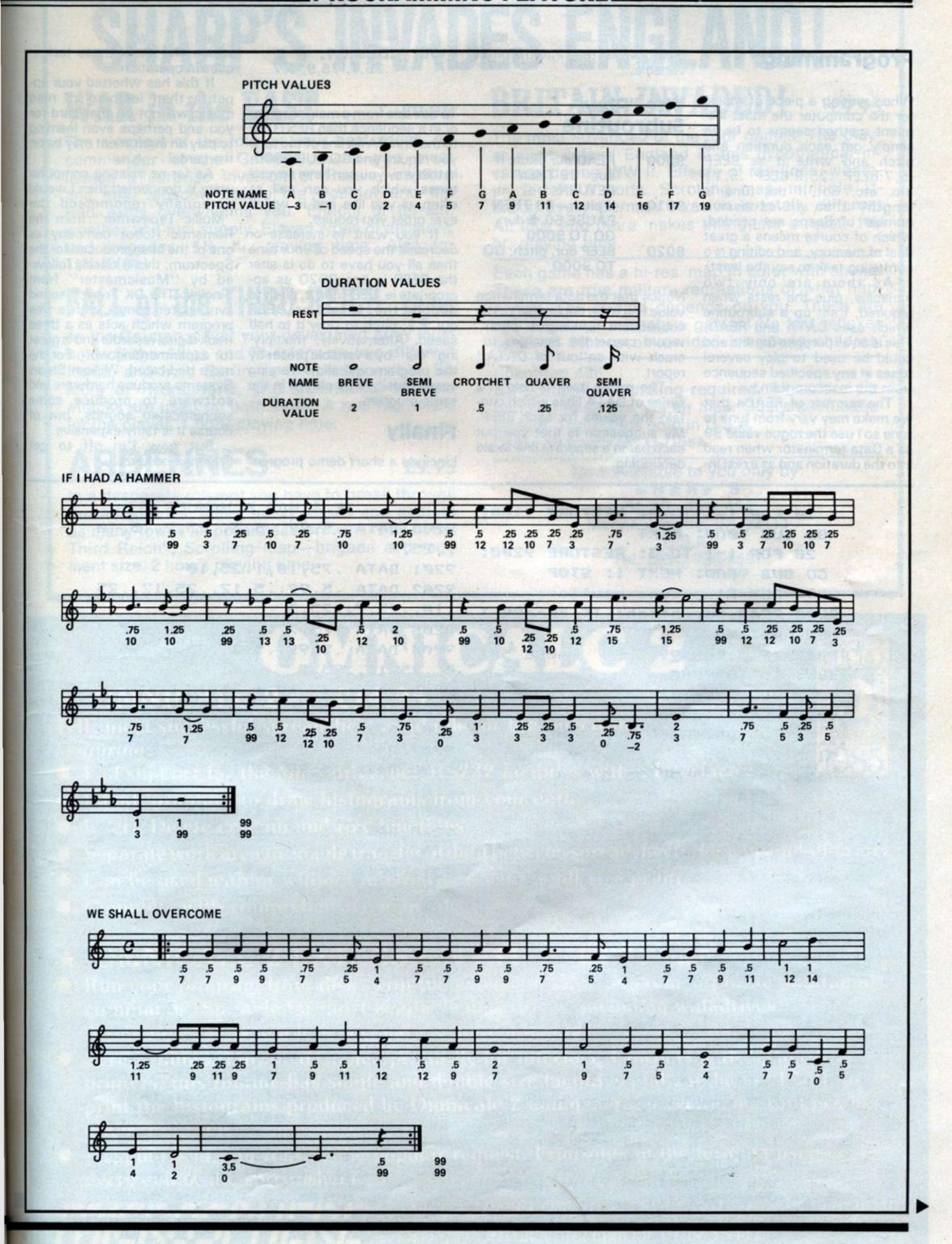
This is determined by the type of blob put on the stave line. These all bear some relationship to each other, if you are familiar with Binary then it'll help, and also depend on the TIME SIGNATURE and TEMPO of the music. In the majority of cases this does not affect the result, in practical terms, when converting to the computer.

In fig. 2 I have given the duration names of the notes and underneath the values which I found most satisfying for the duration of the BEEP. These are easily changed if a piece of music needs to be faster or slower and if you use the system of programming music that I suggest later on, then altering these is very simple indeed. Of course it's not quite that simple, sometimes there is the need for a period of time where there is nothing played at all, these are signified by RESTS and these also have durations which correspond to the durations of the notes, these are given as part of fig. 2

And then there are extended notes, these may be shown in one of two ways, as a dot (.) which comes immediately after the note and this extends the duration by one half the note duration value. For example, a crotchet follwed by a dot (a DOTTED crotchet) has a duration of .75 — the same as a crotchet and a quaver together — .5 + .25.

The other way of extending the length of a note is to TIE it with a line curving between the two (or more) notes. This has the simple effect of adding the duration value of every note so tied, together.

Micro Music


PITCH VALUES
NOTE NAME A B C D E F G A B C D E F G
PITCH VALUE –3 –1 0 2 4 5 7 9 11 12 14 16 17 19
DURATION VALUES
REST
NOTE NAME BREVE SEMI BREVE CROTCHET QUAVER SEMI QUAVER
DURATION VALUE 2 1 .5 .25 .125
IF I HAD A HAMMER
WE SHALL OVERCOME

Programming

When writing a piece of music for the computer the most frequent method seems to be to simply get each duration and pitch and write it as BEEP .5,7:BEEP .25,9:BEEP .5,11 etc. etc. But if the tune is lengthy then an excessive number of Beeps are needed, which of course means a great deal of memory, and editing is a confusing task to say the least!

As there are only two variables, plus the rests when required, I set up a subroutine which uses DATA and READ. This is an all purpose routine and could be used to play several tunes in any specified sequence from the main program.

The number of READs that we make may vary from tune to tune so I use the rogue value 99 as a Data terminator when read into the duration and as a rest indicator when read into the pitch variable.

The "Play" Subroutine

```
9000   READ dur,pitch: If
       dur=99 THEN
       RETURN
9010   If pitch=99 THEN
       PAUSE 50 *dur:
       GO TO 9000
9020   BEEP dur, pitch: GO
       TO 9000
```

Notice that the data termination value has to be duplicated or the subsequent READing of "pitch" would cause the machine to crash with an "out of DATA" report.

The music itself is held in a series of DATA lines which contain the values for each BEEP. My suggestion is that you put each bar in a separate line to aid debugging.

```
9100   Data .5,7,
       .25,7,.75,9,.5,7
```

To use this from a main program or in a sequence then RESTORE to the first DATA line of the tune you require and GO SUB 9000, in this way you can have several tunes which you can call as often as you like and in which ever order you require.

If you want to increase or decrease the speed of your tune then all you have to do is alter the BEEP in line 9020 as appropriate ie. BEEP dur/2, pitch to double the speed or BEEP dur *2, pitch to slow it to half speed. Alternatively, multiplying "dur" by a variable preset by the program will allow varying speed music to be played in the same program.

Finally

I include a short demo program which will show these techniques in operation.

If this has whetted your appetite then learning to read music will not be that hard for you and perhaps even learning to play an instrument may be on the cards!

As far as existing computer ware is concerned then I would personally recommend the "Music Typewriter" from the Romantic Robot company as one of the best produced for the Spectrum, this is closely followed by "Musicmaster" from Sinclair. The DK'Tronics sound synthesizer comes with a free program which acts as a three track digital recorder and is great for experimenting with. For the more dedicated, William Stuart Systems produce hardware and software to produce some sophisticated sounds, but of course it is fairly expensive.

But now I'm off to get Brahms and Liszt. . . . . . .

```
  1Ø FOR i=1 TO 2: RESTORE 91ØØ:
 GO SUB 9ØØØ: NEXT i
  2Ø FOR i=1 TO 3: RESTORE 92ØØ:
 GO SUB 9ØØØ: NEXT i: STOP
8999 REM Play tune routine
9ØØØ READ dur,pitch: IF dur=99 T
HEN RETURN
9Ø1Ø IF pitch=99 THEN PAUSE 5Ø*
dur: GO TO 9ØØØ
9Ø2Ø BEEP dur,pitch: GO TO 9ØØØ
9Ø99 REM data for
       WE SHALL OVERCOME
91ØØ DATA .5,7,.5,7,.5,9,.5,9
91Ø1 DATA .75,7,.25,5,1,4
91Ø2 DATA .5,7,.5,7,.5,9,.5,9
91Ø3 DATA .75,7,.25,5,1,4
91Ø4 DATA .5,7,.5,7,.5,9,.5,11
91Ø5 DATA 1,12,1,14
91Ø6 DATA 1.25,11,.25,9,.25,11,.
25,9
91Ø7 DATA 1,7,.5,9,.5,11
91Ø8 DATA 1,12,.5,12,.5,9
91Ø9 DATA 2,7
911Ø DATA 1,9,.5,7,.5,5
9111 DATA 2,4
9112 DATA .5,7,.5,7,.5,Ø,.5,5
9113 DATA 1,4,1,2
9114 DATA 3.5,Ø
9115 DATA .5,99,99,99
9116 REM some notes may need
     adjusting to suit personal
     taste, I would shorten 3.5
     in line 9115 to 3 and make
     the .5 in line 9116 up to 1
9199 REM data for
       IF I HAD A HAMMER
92ØØ DATA .5,99,.5,3,.25,7,.5,1Ø
,.25,7
92Ø1 DATA .75,1Ø,1.25,1Ø
92Ø2 DATA .5,99,.5,12,.25,12,.25
,1Ø,.25,7,.25,3
92Ø3 DATA .75,7,1.25,3
92Ø4 DATA .5,99,.5,3,.25,7,.25,1
Ø,.25,1Ø,.25,7
92Ø5 DATA .75,1Ø,1.25,1Ø
92Ø6 DATA .25,99,.5,13,.5,13,.25
,1Ø,.5,12
92Ø7 DATA 2,1Ø
92Ø8 DATA .5,99,.5,1Ø,.25,12,.25
,1Ø,.5,12
92Ø9 DATA .75,15,1.25,15
921Ø DATA .5,99,.5,12,.25,12,.25
,1Ø,.25,7,.25,3
9211 DATA .75,7,1.25,7
9212 DATA .5,99,.5,12,.25,12,.25
,1Ø,.5,7
9213 DATA .75,3,.25,Ø,1,3
9214 DATA .25,3,.25,3,.5,3,.25,Ø
,.75,-2
9215 DATA 2,3
9216 DATA .75,7,.5,5,.25,3,.5,5
9217 DATA 1,3,1,99,99,99
9218 REM some note lengths may
     sound slightly too long
     or short, a musician
     would make allowances,
     you may change note dur
     lengths but try to keep
     the total length of the
     notes to a value of 2.
```

Mandolin Keyboard

Gavriel Hajibab of London wrote this brilliant program which will give your Spectrum a musical keyboard.

This program not only turns the Spectrum keyboard into a piano keyboard with an excellent graphical representation of the keyboard, but actually allows you to play more than one note at once! This is achieved by using a vibrato effect and the final result sounds like a Mandolin. Unusual and very pleasing to the ear.

The instrument will play notes over one octave from middle C to upper E. Keys A to ENTER act as the white notes on a piano and the appropriate keys on the line above play sharps and flats.

As you may imagine, the BASIC BEEP could not possibly cope with this, and so Gavriel has resorted to machine code which has to be put into the memory by a special program.

Entering the Program

First type in the program given in Fig 1. This is a loader program which will put the machine code into memory. Now look at Fig 2.

This mass of numbers is made up in the following way, first is a five figure number (starting at 32768) this is the address at which the code is stored.

This address is followed by five numbers, these are the bytes of machine code which need to be entered, and finally there is a number at the end of the line, this number is the sum of all the five bytes of machine code and is used as a check. (See fig 1a. for an example).

ADDRESS	(MACHINE CODE — five bytes)	CHECKSUM.
32768	205 87 130 33 255	710

Figure 1a.

So now run fig 1 and enter the five bytes of machine code, one at a time, pressing ENTER after each one, and when all five have been entered the screen will display a number. This number MUST be the same as the one given at the end of the line. If it is not then answer "y" to the prompt and re-enter that line again.

Once all these numbers have been entered you have finished with the fig 1 program, so type NEW and ENTER, and the machine will give the same effect as when you first switched it on. But don't worry, the code is safe. (If you are worried then SAVE''music''CODE, 1010 before NEWing your computer.)

Now type in the fig 3 program and RUN it. Save the program, there are two sections to it, on tape and verify it. On all subsequent loadings the program will auto run load in the machine code and be ready to use.

If you want to test it without reloading, then type RANDOMIZE USR 32768. When you wish to end your musical renditions then press CAPS/LOCK and SPACE. To re-start after a break use the USR number as above.

FIGURE 1 . Loader Program

```
  10 BORDER 6: PAPER 2: INK 7: C
LEAR 32766
  20 LET CHECK=0: LET C=0: PRINT
 AT 15,12; PAPER 3;"BYTELOADER":
 PAUSE 50: CLS
  30 FOR A=32768 TO 33778
  40 INPUT "(D=DELETE LAST ENTRY
) ";(A);" ";A$: IF A$="" THEN G
O TO 40
  50 IF A$="D" THEN  LET A=A-1:
PRINT AT C-1,0,,AT C-1,0;: LET C
HECK=CHECK-(PEEK A): LET C=C-1:
PRINT #0; INK 4; PAPER 0; FLASH
1;"ENTRY DELETED": BEEP .5,8: PA
```

```
USE 1: PAUSE 5Ø: GO TO 4Ø
  6Ø LET B=VAL A$
  7Ø POKE A,B
  8Ø PRINT A;"  ";B
  9Ø LET CHECK=CHECK+B
 1ØØ LET C=C+1
 11Ø IF (C/5)=INT (C/5) THEN  PR
INT AT 18,Ø; FLASH 1; INK 4; PAP
ER Ø;"CHECKSUM:";CHECK: PRINT :
BEEP .5,Ø: PAUSE 1: PAUSE 5Ø: IN
PUT "ANY CORRECTIONS (Y/N) ";A$:
  IF A$="Y" THEN  LET CHECK=Ø: LE
T C=Ø: LET A=A-5: CLS : GO TO 14
Ø
 12Ø IF (C/5)=INT (C/5) AND A$="
N" THEN  LET C=Ø: LET CHECK=Ø: C
LS : GO TO 14Ø
 13Ø IF (C/5)=INT (C/5) AND A$<>
"N" THEN  GO TO 11Ø
 14Ø NEXT A: STOP
```

FIGURE 2

32768	2Ø5	87	13Ø	33	255	71Ø
32773	127	62	127	219	254	789
32778	2Ø3	71	2Ø2	53	129	658
32783	62	253	219	254	2Ø3	991
32788	71	2Ø4	78	129	6	488
32793	11	14	27	196	53	3Ø1
32798	13Ø	62	253	219	254	918
328Ø3	2Ø3	79	2Ø4	89	129	7Ø4
328Ø8	6	11	14	25	196	252
32813	53	13Ø	62	253	219	717
32818	254	2Ø3	87	2Ø4	1ØØ	848
32823	129	6	11	14	23	183
32828	196	53	13Ø	62	253	694
32833	219	254	2Ø3	95	2Ø4	975
32838	111	129	6	11	14	271
32843	21	196	53	13Ø	62	462
32848	253	219	254	2Ø3	1Ø3	1Ø32
32853	2Ø4	122	129	6	11	472
32858	14	19	196	53	13Ø	412
32863	62	191	219	254	2Ø3	929
32868	71	2Ø4	179	129	6	589
32873	11	14	17	196	53	291
32878	13Ø	62	191	219	254	856
32883	2Ø3	79	2Ø4	167	129	782
32888	6	11	14	15	196	242
32893	53	13Ø	62	191	219	655
32898	254	2Ø3	87	2Ø4	155	9Ø3
329Ø3	129	6	11	14	13	173
329Ø8	196	53	13Ø	62	191	632
32913	219	254	2Ø3	95	2Ø4	975
32918	144	129	6	11	14	3Ø4
32923	11	196	53	13Ø	62	452
32928	191	219	254	2Ø3	1Ø3	97Ø
32933	2Ø4	133	129	6	11	483
32938	14	9	196	53	13Ø	4Ø2
32943	62	251	219	254	2Ø3	989
32948	79	2Ø4	191	129	6	6Ø9
32953	13	14	26	196	7Ø	319
32958	13Ø	62	251	219	254	916
32963	2Ø3	87	2Ø4	2Ø3	129	826
32968	6	13	14	24	196	253
32973	7Ø	13Ø	62	251	219	732
32978	254	2Ø3	1Ø3	2Ø4	215	979
32983	129	6	13	14	2Ø	182
32988	196	7Ø	13Ø	62	223	681
32993	219	254	2Ø3	1Ø3	2Ø4	983
32998	227	129	6	13	14	389
33ØØ3	18	196	7Ø	13Ø	62	476
33ØØ8	223	219	254	2Ø3	95	994
33Ø13	2Ø4	239	129	6	13	591
33Ø18	14	16	196	7Ø	13Ø	426
33Ø23	62	223	219	254	2Ø3	961
33Ø28	79	2Ø4	251	129	6	669
33Ø33	13	14	12	196	7Ø	3Ø5
33Ø38	13Ø	62	223	219	254	888
33Ø43	2Ø3	71	2Ø4	7	13Ø	615
33Ø48	6	13	14	1Ø	196	239
33Ø53	7Ø	13Ø	195	6	128	529
33Ø58	126	87	14	6Ø	62	349
33Ø63	255	243	211	254	238	12Ø1
33Ø68	155	66	16	254	13	5Ø4
33Ø73	32	246	251	2Ø1	62	792
33Ø78	254	219	254	2Ø3	71	1ØØ1
33Ø83	2Ø2	65	129	195	3	594
33Ø88	128	1	64	156	11	360
33Ø93	237	95	211	254	12Ø	917
33Ø98	177	32	247	2Ø1	54	711
331Ø3	Ø	6	11	14	27	58
331Ø8	2Ø5	19	13Ø	24	2Ø1	579
33113	54	225	6	11	14	31Ø
33118	25	2Ø5	19	13Ø	24	4Ø3
33123	19Ø	54	2ØØ	6	11	461
33128	14	23	2Ø5	19	13Ø	391
33133	24	179	54	192	6	455
33138	11	14	21	2Ø5	19	27Ø
33143	13Ø	24	168	54	167	543
33148	6	11	14	19	2Ø5	255
33153	19	13Ø	24	157	54	384
33158	15Ø	6	11	14	17	198
33163	2Ø5	19	13Ø	24	146	524
33168	54	134	6	11	14	219
33173	15	2Ø5	19	13Ø	24	393
33178	135	54	125	6	11	331
33183	14	13	2Ø5	19	13Ø	381
33188	195	34	129	54	11Ø	522
33193	6	11	14	11	2Ø5	247
33198	19	13Ø	195	34	129	5Ø7
332Ø3	54	97	6	11	14	182
332Ø8	9	2Ø5	19	13Ø	195	558
33213	34	129	54	242	6	465
33218	13	14	26	2Ø5	36	294
33223	13Ø	195	34	129	54	542
33228	21Ø	6	13	14	24	267

33233	2Ø5	36	13Ø	195	34	6ØØ
33238	129	54	177	6	13	379
33243	14	2Ø	2Ø5	36	13Ø	4Ø5
33248	195	34	129	54	158	57Ø
33253	6	13	14	18	2Ø5	256
33258	36	13Ø	195	34	129	524
33263	54	143	6	13	14	23Ø
33268	16	2Ø5	36	13Ø	195	582
33273	34	129	54	115	6	338
33278	13	14	12	2Ø5	36	28Ø
33283	13Ø	195	34	129	54	542
33288	1Ø4	6	13	14	1Ø	147
33293	2Ø5	36	13Ø	195	34	6ØØ
33298	129	229	197	193	2Ø5	953
333Ø3	217	13	17	117	131	495
333Ø8	1	2	Ø	2Ø5	6Ø	268
33313	32	225	2Ø1	229	197	884
33318	193	2Ø5	217	13	17	645
33323	121	131	1	2	Ø	255
33328	2Ø5	6Ø	32	225	2Ø1	723
33333	229	197	193	2Ø5	217	1Ø41
33338	13	17	119	131	1	281
33343	2	Ø	2Ø5	6Ø	32	299
33348	225	2Ø1	229	197	193	1Ø45
33353	2Ø5	217	13	17	123	575
33358	131	1	2	Ø	2Ø5	339
33363	6Ø	32	225	2Ø1	62	58Ø
33368	154	5Ø	123	92	62	481
33373	131	5Ø	124	92	33	43Ø
33378	Ø	64	17	1	64	146
33383	1	255	23	54	Ø	333
33388	237	176	33	Ø	88	534
33393	17	1	88	54	112	272
33398	1	Ø	3	237	176	417
334Ø3	62	12Ø	5Ø	141	92	465
334Ø8	62	2	2Ø5	1	22	292
33413	33	229	88	17	23Ø	597
33418	88	1	21	Ø	54	164
33423	96	237	176	33	197	739
33428	89	17	198	89	1	394
33433	21	Ø	54	96	237	4Ø8
33438	176	6	6	62	96	346
33443	33	5	89	119	17	263
33448	21	Ø	25	119	17	182
33453	11	Ø	25	16	244	296
33458	6	23	14	27	2Ø5	275
33463	217	13	1	21	Ø	252
33468	17	125	131	2Ø5	6Ø	538
33473	32	6	16	14	27	95
33478	2Ø5	217	13	17	55	5Ø7
33483	131	1	2Ø	Ø	2Ø5	357
33488	6Ø	32	6	15	14	127
33493	27	2Ø5	217	13	17	479
33498	55	131	1	2Ø	Ø	2Ø7
335Ø3	2Ø5	6Ø	32	6	14	317
335Ø8	14	27	2Ø5	217	13	476
33513	17	55	131	1	2Ø	224
33518	Ø	2Ø5	6Ø	32	6	3Ø3
33523	13	14	27	2Ø5	217	476
33528	13	17	76	131	1	238
33533	2Ø	Ø	2Ø5	6Ø	32	317
33538	6	12	14	27	2Ø5	264
33543	217	13	17	35	131	413
33548	1	2Ø	Ø	2Ø5	6Ø	286
33553	32	6	11	14	27	9Ø
33558	2Ø5	217	13	17	97	549
33563	131	1	2Ø	Ø	2Ø5	357
33568	6Ø	32	2Ø1	152	32	477
33573	152	32	152	32	152	52Ø
33578	32	152	32	152	32	4ØØ
33583	152	32	152	32	152	52Ø
33588	32	152	32	152	153	521
33593	154	153	154	32	152	645
33598	153	154	153	154	153	767
336Ø3	154	32	152	153	154	645
336Ø8	153	154	32	152	152	643
33613	146	147	146	147	32	618
33618	152	146	147	146	147	738
33623	146	147	32	152	146	623
33628	147	146	147	32	152	624
33633	15Ø	151	15Ø	151	15Ø	752
33638	151	15Ø	151	15Ø	151	753
33643	15Ø	151	15Ø	151	15Ø	752
33648	151	15Ø	151	15Ø	151	753
33653	148	149	15Ø	151	144	742
33658	145	146	147	43	43	524
33663	43	32	77	85	83	32Ø
33668	73	67	32	77	65	314
33673	69	83	84	82	79	397
33678	32	43	43	43	Ø	161
33683	Ø	Ø	Ø	Ø	Ø	Ø
33688	Ø	Ø	15	15	15	45
33693	15	15	15	7	Ø	52
33698	24Ø	24Ø	24Ø	24Ø	24Ø	12ØØ
337Ø3	24Ø	224	128	15	15	622
337Ø8	15	15	7	Ø	Ø	37
33713	Ø	24Ø	24Ø	24Ø	24Ø	96Ø
33718	224	128	128	128	128	736
33723	128	128	128	128	255	767
33728	128	128	Ø	Ø	Ø	256
33733	Ø	Ø	255	Ø	Ø	255
33738	128	128	255	128	128	767
33743	128	128	128	Ø	Ø	384
33748	255	Ø	Ø	Ø	Ø	255
33753	Ø	128	128	128	128	512
33758	128	128	128	128	15	527
33763	15	15	15	15	15	75
33768	15	15	24Ø	24Ø	24Ø	75Ø
33773	24Ø	24Ø	24Ø	24Ø	24Ø	12ØØ
33778	Ø	Ø	Ø	Ø	Ø	Ø
33783	Ø	Ø	Ø	Ø	Ø	Ø
33788	Ø	Ø	Ø	Ø	Ø	Ø

Figure 3.

```
10 SAVE "music" LINE 20: SAVE
"maestro"CODE 32768,1010
20 CLEAR 32766: LOAD ""CODE
30 RANDOMIZE USR 32768
```

Midi In The Home

Talented? Musically frustrated? Read on . . .

There is a growing trend towards using the computer as a tool in the composition and performance of music using the new range of low cost keyboards and synthesisers. We decided to keep up with this trend and present a guide to what is available and how it can be used for both expert and newcomer alike.

As we are a computer magazine we are concentrating on this aspect and our information on the instruments is not "in depth" — this could be the subject of a magazine in its own right!

Arguably, CASIO are the Sinclair of the keyboard world, three years ago their £40 machine caused as much stir as the ZX81 in its day, and even now their CZ101 is the cheapest MIDI machine on the market at around £350.00. I know several people personally who owned an early Casio, went into computing and, returning to bigger machines have now linked both interests together, and they are not all millionaires either — one is a schoolboy and another is unemployed!

Instruments

JVC KB600 £650.00 Arbiter Ltd.

This machine has 49 keys (4 octaves), 10 voices, PCM drum sequencer with 14 preset rhythms and 4 variations on each for drums, bass, rhythm, and arpeggio — each with individual volume control. The keyboard can be split as desired so that left and right halves of the instrument can play different voices, the voices are in two groups so that some voice combinations are not possible. There is a chord and rhythm sequence recorder and a melody line can also be recorded. One finger chords are provided or full finger chording, and the rhythm unit follows the chord played on the left hand. A useful feature is Ultra Chord which adds an appropriate harmony to notes on the right hand in relation to the chord played on the left.

You cannot create your own rhythms on the basic machine but for an extra £120 JVC also produce a Composer unit which plugs in and makes this feasible. This machine seems aimed at the home user rather than the professional, a 2.5 Watt stereo amplifier is built in and is very loud in an enclosed room. Output is via phono plugs rather than the professional standard jack plug. Optional extra accessories include a stand, expression pedal (volume) and carrying bag.

This is a high quality unit which allows inexperienced players to produce interesting sounds quite quickly, but which is also versatile enough to please the experienced. A graded set of tunes in script form complete with suggested settings is also included. The drums sound very realistic, though a little monotonous, a common problem, and the voices are very good — note though, that you cannot alter them, the Jazz Organ, Piano, and Harpsichord in particular, but this is very much a matter of personal preference. Manual drums can be played and there are 24 percussion effects!

Arbiter Ltd, JVC House, Eldon Wall Trading Estate, Staples Corner, Priestley Way, London NW2.

Siel MK900 £459.00 Siel (UK) Ltd.

Spectrum users will feel at home with this one as the control buttons have the same kind of rubbery feel that the original Spectrum had!

However, this is no criticism, the thinking behind it being that a musician wishing to change something during his performance would not be over gentle in hitting the button and for this they are ideal. This instrument features 61 keys (5 octaves), 10 voices, a rhythm unit which includes drums, bass, rhythm and arpeggio and 10 preset rhythms. You can program your own rhythmic sequences from the manual drum option which has four percussion effects. One finger chording, which the rhythm pattern follows is available on the left hand part of the keyboard which can be split into any of three preset positions.

The power supply unit is separate from the instrument and is plugged in in a similar manner to the Spectrum's PSU. A 4 Watt per channel stereo amplifier is built in, which is *very* loud! A counter melody option adds harmonies to the melody line and an interesting feature called "left to mono" plays the top note of right hand chord as a separate single note in the left hand voice.

The drums are not very realistic and rather limited, however the rhythm patterns are very good and have a nice "feel" which makes playing along easier. After a little confusion the machine fell into place and I found it easy to get what I wanted, the five octave keyboard gave a healthy range and the sounds were very well created. In particular I liked the Pipe Organ, Strings and the Trombone, the latter not sounding quite like the real thing, but giving a great sound anyway. It is more for the player with added accompaniment, but versatile enough to enable an inexperienced musician to make good music.

Siel (UK) Ltd, AHED Depot, Hookwood, Reigate, Horley, Surrey RHG OHY.

Siel DK80 £699.00

A deceptively simple looking machine which is a true synthesizer at a reasonable price.

It features 12 voices, double sound generation, dynamic keyboard (usually only found on instruments at twice the price), 87 programmable parameters, ASDR, two DCO's and VCF's and four LFO's (see glossary). MIDI IN, OUT and THRU sockets are provided and both OMNI and POLY modes are available.

This unit actually represents great value for money, having many features normally not included on the cheaper synths — such as a pitch wheel, for instance. The Midi format is very well implemented, and they market their own interface and software which is, naturally, compatible. Unusual for this kind of instrument is a sequencer recorder which allows two-track recording of two independent sound generations. A full five octave, 61 key keyboard is fitted.

This is an exciting machine, which could take up hours of your time playing with the different sounds and the millions of variations. The fifty alterable sounds supplied show the range of instruments which can be mimicked and the beautiful (and weird) sounds possible. If sound, professional quality, and versatility are what you want, coupled with a comparatively simple set of controls then this one demands your attention.

Siel's address is as previously mentioned.

Korg Poly 800 £635.00 Rose Morris & Co Ltd.

This has proved to be a popular machine, and computer users are made to feel at home by the little joystick fitted in the top left corner of the instrument!

The keyboard has 49 keys (4 octaves) and the rear has two main panels, a raised control panel and a flat reminder panel, the latter simply shows the related parameters and possible values and is there to provide information rather than having any function. It features a MODE function which allows you to choose between a single DCO operation with eight voices or two DCO's of four voices each. VCf on three DEG's (Digital Envelope Generators) which include the ADSR. A step time sequencer is built in which provides a 256 note memory.

MIDI is very comprehensive but in the short while I had the unit I couldn't find out how to switch from POLY to OMNI mode which the specifications said it would do. However I found that OMNI is not essential, although it can be useful. This is another fairly simple to use machine with a tremendous range of sounds and options, it may seem a bit expensive but it is well built and has many extra features which may be useful to you, such as the joystick pitch

blend (L/R) and DCO/VCF modulation (U/D).

Rose Morris and Co, 32-34 Gordon House Rd, London NW5 1NE.



Casio CZ-101 and CZ1000 £345/£499 Casio Electronics

We couldn't go without looking at the Casio machines. These two are essentially the same, but the CZ1000 has full-sized keys rather than the miniature CZ-101 version. Apart from that they are identical in operation, so, are full size keys worth £150.000 to you?

The units have two sets of DCO, DCW and DCA parameters, an envelope generator with eight preset values, and a 49 key keyboard. There are 16 preset, 16 programmable and 16 optional RAM voice memories, 48 tone memories and programmable pitch bend and portamento. Even though the range of sounds is limited by the use of presets for some parameters there is still a wide range of sounds and a tremendous variation in each to be explored.

This is the ideal instrument for those who wish to experiment and have no preconceived ideas of what they are trying to produce. I think it may be too limiting for a synth expert who has audio images in his head, but for most of us it is a wonderful machine with enough scope to keep us happy for hours. It also provides a reasonably cheap means of acquiring a second machine to layer or connect up to form a Midi orchestra.

The small size of the keys on the CZ-101 may cause problems to trained musicians, as fingers tend to get in a twist, however the average person should not find any problems and you soon get used to their size. I liked it a lot and suggest that you try one out before parting with almost twice the money for a "real" one.

Casio Electronics Ltd, 1000 N. Circular Rd, London NW2 7JD.

Caution!

In nearly all the instrument manuals the Midi functions have been rather vague, though the Siel and Korg manuals were very good.

It is important that you check that the machine will do what you want it to do and therefore it is worth checking on the following modes which may or may not be operational on the instrument:

OMNI mode is a general all-purpose mode where the instrument receives and plays ALL the information sent to it on all 16 channels. It transmits signals on channel 1 only. This is useful if you want to write and play parts for a single instrument or do simple layering. It is USELESS if you want to create multi-instrument parts each playing independently through several machines. The better instruments feature this as well as Poly mode. The JVC in common with most keyboards was OMNI mode only.

POLY mode is the mode in which you assign a channel to the instrument and it only plays the information sent on that channel, there are 16 channels and the info on the other 15 is ignored. This is essential for creating multi instrumental musical pieces, but can be time consuming if you have to keep adjusting recordings to accommodate at the testing stage, this is where OMNI mode is useful.

Most synths run in POLY Mode, but check before buying!

There is a third mode, MONO but this tends to only be included on the top end of the range, ie. £1000.00+ instruments. ▶

Interfacing

The instrument is connected to the computer, as you may have guessed, by an appropriate interface. This interface consists of a means of connecting and converting the signals from the DIN pin connector to the Spectrum via its user port. The bare essentials must be a MIDI OUT socket to send information to the instrument's MIDI IN socket, a MIDI IN to get signals from the instrument's MIDI OUT and preferably, but not technically essential, SYNC IN and SYNC OUT sockets to enable control of, or from, an external source such as a MIDI drum unit.

Software

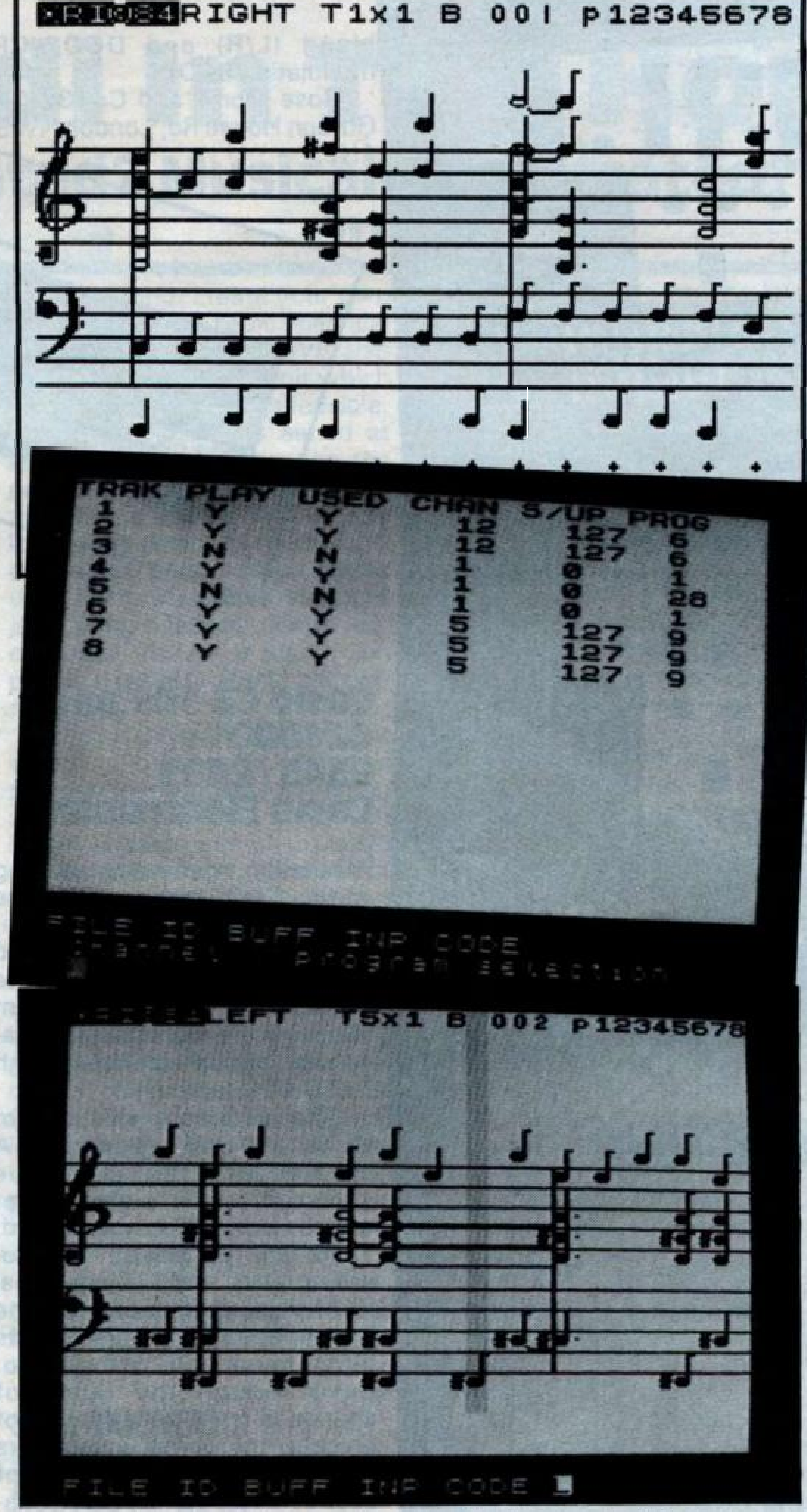
The range and applications are extending daily, but the most common and most generally useful are the following:

SEQUENCER
This stores and replays a series of notes. These are computer variations of what is often built into an instrument but have advantages in that it can be easier due to a higher degree of control and editing of the music.

There are two main modes, STEP TIME which is writing music note by note as many computer music programs tend to be written, and is like "music by numbers". The advantages are that it is easy to convert from manuscript to machine and editing should be very easy. It is also a great way to experiment as mistakes are not fatal, and the graphic displays can be impressive.

The disadvantages are that some knowledge of music is needed and it takes a very long time to produce tunes of any great length. The second is LIVE or REAL TIME and here the player simply plays and the computer records what has been played. Favoured by the "play by ear" musician and those with little or no formal training. Disadvantages are that editing is difficult if not impossible and graphic representations are not usually possible.

EDITOR
Only of use to the synthesizer owner, this makes creating or modifying sounds a fascinating and much easier job as you should get a graphic representation of the sound you're working on. Only the most expert (and that does not include me) can "hear" a sound and visualise the parameters required. Although I have tried to be simple and clear in my explanations I know when it comes to the modulating effects many readers will have given up. If you could see it graphically and hear the changes whilst seeing them then I'm sure you'd agree that this is one area where a picture really is worth a thousand words! An Editor is an essential and important application, especially as sounds can then be stored and recalled.



COMPOSER
Again this can be Step Time or Real Time. At the moment there is only one company with a completely real-time composer program, and that is Electromusic Research, run by Mike Beecher (marketed by Rose Morris Ltd).

Having made this statement there will probably be several others which have been produced since this was written — let us know and we'll put the record straight.

A Composer program is similar to a sequencer program except it tends to be used to hold several parts which go to make up a piece of music, ie. Bass line, Violin sections, Brass sections etc. These may play different pieces of music at different times and is useful if you have more than one instrument or "slave" units, such as Siel's EXPANDER. These are rather specialised but we will look at them as I do know of some people who get together with their machines, link them together and have their own orchestra!!!

Micon Interface £108.00 XRI Systems

(Including Step and Real Time Interfacer)
This is one of the cheapest on the market and it shows in the rather functional look of the interface, but don't be put off, it works perfectly and is easy to use. The Interface is a large plastic box which stands upright and is connected by a small plug, the DIN sockets are fitted at the top of the unit and consist of MIDI IN, two MIDI OUT, and SYNC IN and SYNC OUT. This arrangement may pose problems if a lot of lead swapping is required during a program run and buying an extender cable helps eliminate this, otherwise it is stable enough.

STEP TIME SEQUENCER
The Software is top quality, especially the Step Time sequencer, this allows for ten one-note tracks to be recorded either singly or in blocks of chords.

The procedure is to select which track you want to record on, indicate how many other tracks you want to involve (2/3 for chords perhaps), press the note(s) and tap the Space bar to enter it. The note(s) appears on the stave in the base time length — down to 1/32 of a note, as previously decided by you — and further taps of the space bar increase the note length in steps of the base value. This can be repeated until all ten tracks are used, previously written tracks can be edited or completely overwritten.

This is a very powerful piece of software, and all the control options you could think of are included, such as Tempo, Patch change, Replay with or without music displayed (time is not accurate, but acts as a "trace on"), and individual channel assignment to each track. A copy to microdrive facility is included and I converted it to Disk in about ten minutes.

REAL TIME SEQUENCER
The Real Time Sequencer acts as a simple recorder which replays the music as you play it. It worked perfectly but I found that it didn't have the same interest for me as the other program. It performs a task similar to the sequence record option built in to most keyboards. I must add though, that it does allow ten individual recordings to be made, a far greater number than usually supplied, and this ability is not usually included on synths.

On Test

I tried it with the POLY 800 and the JVC KB600 and it worked well on both. The JVC disappointed me because it only functioned in OMNI Mode, ie accepted and played the music from ALL the channels. This means it is not suitable for playing specific parts of a composition. It also only played in one voice and the drum/rhythm unit was not triggered, this means that all the sophisticated extras were unavailable when using Midi.

However, some impressive single voice stuff can be produced, (after all, a Piano only has one voice!) and by splitting the keyboard so that all the keyboard is the left hand and then splitting the voices, you can record a chord and rhythm backing and add a live melody in a different voice.

The Korg performed as expected, except that I had problems making the patch-change operate mid-way through a piece of music.

Assessment

Impressive, especially the software, and well worth the money. My only real criticism is that the instructions, although well written are supplied on single sided computer printout paper, and trying to find something by searching through twenty four joined sheets was most frustrating. In the end I pulled them apart and filed them in a ring binder — end of problem.

XRI Systems, 10 Sunnybank Rd, Sutton Coldfield, W. Midlands.

JMS Midi Interface £94.95

Sold by both SIEL and ROSETTI, for two different prices (£74.00 and £94.95 respectively) this Italian interface is a very professionally made unit. It consists of two units connected by a ribbon cable some 60cms long. This means you can plug or unplug DIN sockets, while connected to the Spectrum, with confidence.

One end of the cable is fitted to a slim, tall box which fits on the user port, the other end is attached to the middle of a large box with the DIN sockets either side of it. There are three sockets on the left, Control IN for a rhythm unit or pedals, THRU and MIDI IN. On the right are three further sockets, all MIDI OUT. The only visible difference between the two versions available is that the Rosetti interface is bright blue with JMS on it and the Siel one is black with "SIEL" written on it!

Software from either company runs on either interface, though the Micon software did not work with it. All in all, this is a sturdy, good looking, well designed piece of equipment.

Rossetti Software

8 TRACK COMPOSER £49.95
LIVE SEQUENCER
ARPEGGIATOR £19.95
(See our Special Offer Coupon for Rosetti's address)

Two things are immediately obvious with this company's wares; first, they all come in distinctive blue library cases and secondly the instructions, although commercially printed are VERY brief. There is less said on the Arpeggiator leaflet than on most cassette inserts. The assumption is that you should know what you are doing, both musically and computer-wise.

Having moaned, it is only fair to say that as a user with only general knowledge I really didn't have any major problems, except that I couldn't operate the Arpeggiator with the footpedals supplied. This was a pity as this is a very strong and interesting feature of the program.

The Arpeggiator

. . . was interesting but of limited value, useful for playing along with and, when used with the footpedals, can store and replay in sequence up to 40 chord arpeggios. It would have been more use if the patterns could have been varied rather than the fixed run up or run down the chord notes. A feature to allow you to decide the order of play or a random option would have made this much more versatile. Verdict; fair, a pity it wasn't developed further.

Live Sequencer

The computer acts as a straighforward tape recorder — well, slightly more actually as you can also auto start it or playback at varying tempos without pitch distortion, and loop the sequence so that it replays continuously. Oh, and you can also get the machine to smooth out and adjust the tempo and reassign the channel so that another instrument replays it.

It is enjoyable to use and a little more versatile than most built-in sequencers, though whether you decide it's worth £29.95 is up to you and the use to which you want to put your machine.

Composer

This is Rossetti's star program, it is very similar to the XRI step time sequencer, and is not really my idea of a full composer program.

This one merited four and a bit pages of a leaflet! It actually took me an hour to get to grips with the program and I was quite impressed. Each of the eight tracks hold only one-note sequences, these are played into the computer from the keyboard, the only thing that is recorded is the pitch of the note, all note lengths are set to quavers. Once the sequence has been played then the fun begins. Lines of music shorthand are presented in five rows which are the note or line number, pitch eg. 4D (note D in 4th octave), duration as a note symbol, gate time (sustain), velocity (volume). The last three are alterable (editable) from a cursor and this is where a composition takes shape.



A wide range of editing options are provided and you could then go away and work completely on the computer. Each of the eight tracks are entered in this way and edited, and each can be assigned to individual channels and replayed. A very worthwhile program and one which could help in your quest to produce music. However, as with all their programs I feel that there could have been more to it, the method of entry seems an uneasy compromise between the musician and the computist. Perhaps this may have the effect of appealing to both.

The graphic content of all these programs is very elementary and most consist of menu options and prompts; information is given clearly and plainly and the whole set is functional and workmanlike. I may have given the impression that I don't like these programs but I must assure you that this not so, they are all competent and will add new dimensions to your music, I was sad when I returned them to Rosetti — I think I'll take up their offer. . .

Siel Programs Live Sequencer £122.00 Sound Editor £54.35

Two variations on each of these programs, each designed for the Siel instruments, either the DK600 range (£999.99) or the MK80 range. Although primarily for their synths, they often work with other instruments, this is well worth checking especially for the Editor which is superb! (but I couldn't get it to work with the Korg).

But first, a mention of the Sequencer, this does the same job as the others mentioned, neither better nor worse, so what else is there to say except that it worked on the JVC as well as the Siels?

Sound Editor

This is the "Ultimate" program of the synth world. It has everything, great graphics, user-friendly and (eventually) what sounds!

The program is menu driven and every screen allows you to access an appropriate help page. Most of the program operates from screen pictures selected by cursor. From the larger master displays you change to more detailed panels and as you alter the settings of the graphical knobs they change to the correct position.

The DEG shape is displayed and modified as you alter the parameters, and there is also a histogram and numeric representation of the parameters. Colour is used well to highlight all these displays.

The only blemish on the horizon is a warning they give that some issues of Spectrums cause a problem with the CHORD option, the synth doing a Sinclair type reset. This did in fact happen and, as I was using a Spectrum +, it is likely that this option is 95% useless.

I loved the PLAY test option which arpeggios up and down and around the scale to try out the sound, I could listen to it for hours. You guessed it, I'm impressed.

If you've got a DK80 then this program is a must, and if you haven't then it's a good reason for considering buying one! All their documentation is on double thickness printer paper, (rather down-market) it is easy to understand yet enough information is also provided so that a machine code expert could write his own programs.

Rose Morris Interface and Software

At the time of going to press we have not yet received their products for review. We know though, that they were produced by Mike Beecher of Electromusic Research who we featured in a recent issue, which is an indication of high class. If they arrive we will update this article in the next issue but meanwhile I recommend that you take them into consideration before making your choice. Their Composer in particular is impressive.

And Finally . . .

The prices of the instruments will vary quite a lot from place to place so don't take them as gospel, they are meant as a guide.

I must say a sincere thankyou to all those who lent me all this very expensive equipment, Vince Hill Associates and Siel, Mr. Chapman and Rosetti, Richard Young and Casio, XRI (who have just brought out a Juno 106 and DX7 editor and are about to release a composer program) and Paul Waby for lending me his Korg.

Glossary

Some terms for the uninitiated.

ADSR: These are the four main variables of the average envelope generator, and stand for ATTACK — the speed at which a note reaches full volume, DECAY — the rate which it then drops to its playing level. SUSTAIN — this is the level at which the note sounds continually, and RELEASE — the speed with which the note fades away after the key has been released.

ARPEGGIO: series of notes which form a chord played in sequence.

DC-: Digitally Controlled item. Synthesizer operations are controlled either by numbers (digits) or by voltages, the newer system is digital but there are still advantages to the earlier means of using voltages. Many synths have a combination of both systems. Some operations are Digitally Controlled Oscillators — DCO. Digitally Controlled Amplifiers — DCA.

FILTER: These are designed to block out frequencies selected by the user, this changes the quality of the note produced by the oscillator and allows you to adjust the "tone" or timbre of the note. Most frequently controlled by voltage as in VCF.

KEYBOARD: Generally accepted as being an instrument which has several preset and unalterable sounds or "voices". These are often bundled with sophisticated extras such as rhythm units, sequencing and recording facilities.

LAYERING: Using more than one voice, usually played in unison to create the final sound. This is the most elementary way in which MIDI can be used by simply connecting two or more synths/keyboards with a five pin DIN lead.

LFO: Low Frequency Oscillator, this is used to "fatten out" a tone or as a modulating waveform.

MIDI: Musical Instrument Digital Interface, the interface which should be (and is getting close to) a universal standard for transmitting information to and from a musical instrument. Note that these are in two forms for our purposes, as fitted to the keyboard/synth in the form of DIN sockets and as the familiar add-on unit to be plugged into the back of the long suffering Spectrum.

MODULATION: Using a predefined voltage or control (LFO) to adjust and modify a target sound.

OSCILLATOR: The source of the sound, a signal generator, as in DCO.

PATCH: A set up of the synths sound generation which is stored for later recall. Similar to a "voice" on a keyboard.

PCM: Pulse Code Modulation, this is something we computer users are more familiar with, in effect it is a form of sound sampling, storage and replay. It tends to produce startlingly realistic sounds but with a mechanical "feel" to them. Often used for drum reproduction.

SEQUENCER: repeated patterns are usually stored in memory and replayed "in sequence". This is often an inbuilt feature but the computer variations usually offer a lot more versatility and control.

SYNTHESIZER: An instrument which generates a sound which can then be modified by the adjustment of VCF's, DCF's, LFO's and a wide range of tone and pitch controls. The end result is that many instruments can be mimicked very accurately and some strange and very unusual sounds can be created.

VC-: Voltage Controlled item, this is essentially how the thing operates, but adjusting the sound via voltage variations to such circuits as an Oscillator — VCO, Filter — VCF, or Amplifier — VCA.

WAVEFORM: The form of the oscillation produced electronically usually these can be produced in one of two forms, SQUARE, which produced flutish, smooth sounds and SAWTOOTH which produces brassy sounds.

Software

Music Maker £1.99
Malan
PO Box 390, Purleigh, Essex CM3 6OO
Not very good and probably not worth even the low asking price.

Play, Type and Transpose £4.95
Hilton Computer Services
14 Avalon Rd, Orpington, Kent BR6 9AX
A waste of money.

Music Maker £5.75
Bellflower Software
6 Rosewood Avenue, Greenford, Middlesex
Disappointing, not bad for an early attempt, but slow and limited.

Spectune £4.95
XORsoft
Very good; a good teaching section will help you learn the basics of music, both step time and real time record/play. Recommended, especially if you have little or no musical knowledge.

Music Master £7.95
Sinclair Research
A good program though rather expensive. S/Time and R/Time entry and good playback and printout options. Instructions somewhat sparse.

Music Typewriter
Romantic Robot £9.95
113 Melrose Ave, London NW2
Excellent, although S/time entry only. Graphics and ease of use make this program worth the high price. Printout option provided and accurate timing on replay. Top marks!

Make Music £5.95
Buffer Micro Ltd.
3120 Streatham High Rd, London SW16 6HG
For use with any programmable sound peripheral using the AY-3-8912 chip, this simulates a three channel recorder. Could be useful.

Firework Music/Water Music £5.95
Jumpy Snake Blues/Honkey Tonk £5.95
Software Cottage
19 Westfield Drive, Loughborough, Leics, LE11 3QJ
Two packages, each containing two programs which are drill and practice exercises in the form of games. An interesting and painless way of improving your knowledge of musical notation.



Hardware

BEEP AMPS
These simply amplify the volume of the Spectrum BEEP
DK'Tronics £14.95 (interface and separate speaker "pod")
Unit 6, Shire Hill Ind. Est. Saffron Walden, Essex CB11 3AQ
Cheetah £9.95
24 Ray St, London EC1R 3DJ

Sound Units

These have a built-in sound generating chip, usually of the AY type and offer three channels of programmable sounds for music or effects.

DK'Tronics £29.95
Separate speaker and interface, AY-3-8912 chip. Good software program to use as a three track recorder supplied with the unit. Takes a bit of time to get used to but produces very effective sounds.

TRICHORD £29.95
Newtech (Micro) Developments, 1 Courtland Rd, Newton Abbot, Devon TQ12 2JA.
For both the ZX81 and Spectrum, this small but surprisingly loud, all-in-one interface is superb. The difference between the ZX81 and Spectrum unit is ONLY the software, so you can get one for your '81 and if you upgrade to the Spectrum use it with that for the price of the appropriate software.
I respect this company as they have always been helpful and seem to supply good backup to their customers who write from all over the world. Peter Moore, the designer, is known to our regular readers for his hardware project articles (last month's was a Beep Booster). Backup provided includes the production of music books containing Trichord arranged coding. The first in this series is "Christmas Carols" and contains 25 carols set out in the tricord code (three columns of note/octave shorthand — C2) and the words. This is on sale from them for £5.95 with 50p p&p for European sales and £1.50 for the rest of the world. (No extra for GB.) Highly Recommended.

William Stuart Systems
Quarley Down House, Cholderton, Nr Salisbury, Wiltshire, SP4 0DZ
This company markets a range of sound add-ons for both the ZX81 and the Spectrum and they have some interesting software, an arpeggiator and a composer program. Using their products you can produce some of the effects described in the Midi article.
I suggest enthusiasts phone them on 098-064-235 and discuss your requirements with them. An example of their products is the MUSIC SYNTHESISER (ZX81 and Spectrum) £25.50, this is similar to the other units except that up to three can be used simultaneously to produce 9 music channels. An offshoot of this unit is that 16 input/output lines are also provided for control of switchable devices.

A PUZZLE FOR THE QL

—by David Nowotnik

The first few months of existence for the QL have not been happy ones. The computer and its producer have deservedly received a lot of criticism from the computer press. But now that many of the 'rough edges' have been smoothed, the QL is beginning to fulfil all those pre-launch promises made for it. The QL will be a big seller, and, no doubt, many Spectrum owners will be making the transition to the QL. To help with that transition, this article will be offering advice to Spectrum and ZX81 owners to adapt to Super BASIC. And, for QL owners, there is a 'serious' game to play on your 'serious' home computer.

In the same way that the BASIC of the Spectrum was derived from that of the ZX81, so does QL's programming language owe much to its predecessor. I'm sure we'll see yet better versions of BASIC in the future, but SuperBASIC deserves its name by present-day standards. Spectrum owners may care to glance at the program listing in this article; many structures may look familiar, but SuperBASIC also has much more to offer. Particularly notable are PROCedures, and here's why —

Procedures are similar to subroutines, but there are enough differences to make them much more powerful. Procedures work on their own set of variables (although you can pass variables to and form PROCedures in the normal way). Using the LOCAL command, you can identify those variables which are used within the PROCedure. Even if they are identical in name to variables within the main routine or other procedures, use of the LOCAL command keeps them quite independent. This leads to an interesting and powerful possibility. You can readily build up a library of PROCedures. You need only know the input and output variables, and, of course, the purpose of the PROCedure, and your PROCedure can be slotted into any program in which it might be required. And the QL's powerful line renumber facility can replace the PROCedure to any position required in a program.

You call a procedure simply by using its name. Hence, in my program, when you see 'init' or 'set_up' in a program line, these are effectively new commands calling the procedures of that name. Even when the program is not running you can call a procedure by typing in its name — as you would a direct command.

The use of PROCedures, and some of SuperBASIC's other constructions encourage what is commonly called structured programming. A simple way of looking at this is that GOTOs and GOSUBs are excluded (although the QL still has these if you really must use them); the aim is to make programs more 'readable', making them easier to understand and de-bug,

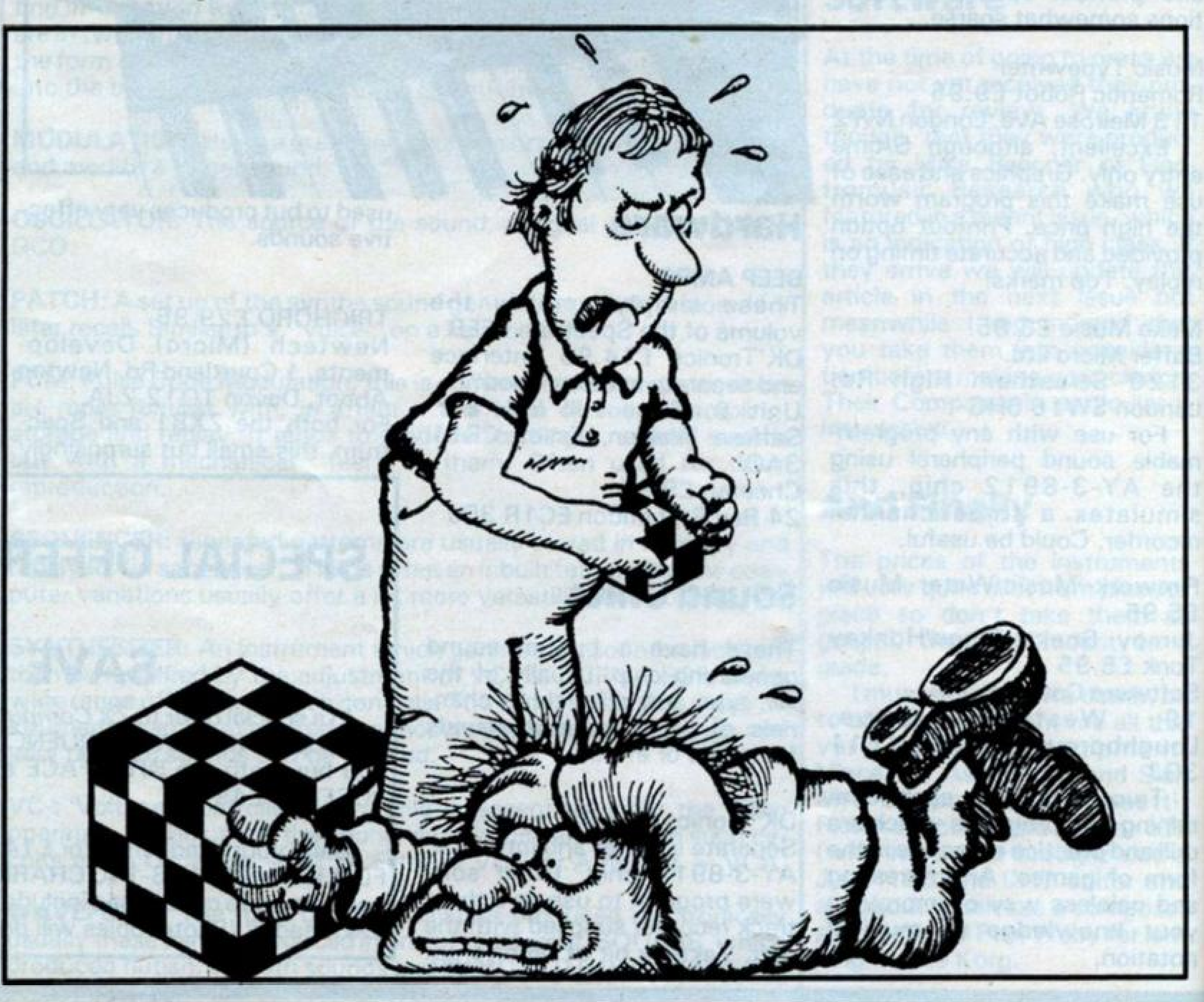
The strategy of program writing in SuperBASIC is quite different to Spectrum BASIC. You aim to build up a series of PROCedures, each being a distinctly independent new command, which you can test and de-bug, before moving onto the next PROCedure. The program is then brought together by calling these new commands in the correct sequence. See if you can spot that design in my program. Even if you can't see that, one thing for sure — in the true spirit of the QL, you won't see any GOTOs or GOSUBs!

The main ways by which you can avoid using GOTOs are in the modified format of IF. . . THEN, and the new command of SELECT. You'll see both in my program. You can use IF. . . THEN in the same way as on the Spectrum, but you have a more powerful option of IF . . . THEN . . . ELSE . . . END IF. To use this form of the IF command, start with the line:

IF condition THEN

Put nothing after the THEN; you can place several statements on any number of lines after this line, and all will be carried out if the condition is met. If you want to have some instructions if the condition is not met, then the ELSE command follows next. Again, you can have several program lines following ELSE, all of which would be carried out if the original condition was not met. Finally, to inform the computer that you have come to the end of the IF structure, use the command END IF (for an example, see lines 800 to 830).

Examples of SELect appear in lines 5550-5650 and 8000-8120. SELect enables the value of a variable to be tested, and various actions to be performed as a result of that test. In line 5560, the first statement'=1' effectively means 'if the variable move_one is equal to one then. . . '. As with the IF command, you could have several lines of options if you wish before testing another value of the variable. You even have an ELSE equivalent with SElect. You can say ON REMAINDER, and have several





programs lines on what to do if the variable does not have any of the previous values tested. SELect is a more powerful variant of the IF command.

Other features you may spot in the listing are the two types of loop structure. FOR. . . NEXT is one you'll know from Spectrum BASIC, but REPEAT may be new to you. An example appears in lines 50 to 110. The end of the REPeat loop appears in line 110. The loop is given a name (in this case 'demo_option', and the loop is ended with 'END demo_option'. You can go around this type of loop forever if you don't have some exit possibility. With a REPeat loop, to exit the loop a condition normally has to be met (see line 70 for the construction). The EXIT command effects a GOTO, to the line immediately following the END REPeat.

While I blandly said Spectrum owners will recognise FOR and NEXT on the QL, there are modifications which can make the QL version more powerful. These are EXIT and END commands, similar to those for the REPeat loop.

All the preceding explanations of QL commands should make my program listing reasonably clear to Spectrum users, but there remains one more item to explain before I describe the program itself. In use, the program will demonstrate the powerful WINDOW, SCROLL and PAN commands of the QL. By using WINDOW, you can identify to the computer a specific area of the screen, which you can control in many ways quite independent of the rest of the screen. For instance, you can print to that window, SCROLL or PAN the window, or change the colour of that window. Lines 1070 to 1110 re-define the shape and colour of two of the windows which are 'provided' by the computer when it is switched on', and lines 1120 to 1240 define 13 new windows which are used in the game. The window is identified by the £ number; this is the channel which 'communicates' to that window. The initials 'scr_' indicate that the device you are aiming that channel at is the screen, and the numbers which follow those initials define the width and height (in pixels) of the window, and the position on the screen of the top left-hand corner of that window.

SCROLL is a command which appeared on the ZX81, but disappeared on the Spectrum. The much more powerful version on the QL allows a window to be SCROLLED up or down, and by a specified number of pixels (for examples, see lines 7140 and 7640). SCROLL can be modified further to SCROLL only a specified number of rows of pixels within a window. The command PAN allows the specified window to be SCROLLed either left or right.

You will notice quite a few REM statements in my listing. This is quite deliberate, for the following reason. One disadvantage of PROCedures compared with GOSUBs is that the former can be used anywhere in the program. So can a GOSUB, of course, but not without a line number to identify its place in a program. So, to make the QL program easier to read, I have identified the start of each PROCedure with a double row of stars, with the name of the PROCedure about to be defined held within the stars. You should do something similar if you want your QL programs to be readable.

And now, at last, the program itself. For me it has a short history, and you may be interested in the story behind the game. It originated three years ago when, whilst teaching myself Z80 machine code, moving blocks of characters around the screen developed into a game idea. What resulted was a mixture of the Rubic Cube, and a sliding puzzle. It was the similarity to the former which inspired a friend to nickname the program after myself, and that name stuck when the ZX81 version was marketed by a software house. I went on to produce commercial versions, bearing the same name, for the Spectrum and Oric Atmos. This is my first version for the QL.

When you RUN the program, you will get a choice of options, for a demonstration, or to play the game. The demonstration will show you the starting (and finishing position) of the puzzle, and the way in which it is shuffled, for you to return to its original orientation.

The puzzle appears as a large square on the screen, which is divided into four smaller, coloured squares of red, yellow, blue and green. If you watch the shuffling movement carefully, you should notice that there are 8 possible ways in which the puzzle can be moved. Imagine that you can divide the puzzle into two equal halves, both horizontally and vertically. This gives you 4 possible 'halves'. The movement of these halves involves sliding a half in the direction of its longest side. As each half could be moved in one of two directions, there are a total of 8 ways in which parts of the puzzle can be moved. In sliding half of the puzzle, the piece which 'falls off' the edge of the puzzle re-appears on the opposite side.

The same eight movements are used to solve the puzzle. On the screen, you will see numbers and arrows. The numeric keys 1 to 8 are used by you in solving the puzzle. The arrows show you which number will move which half, and in which direction. The object is to re-form the original four large squares and place them in the same arrangement they were in prior to shuffling. At the top right of the screen you will see a miniature version of the final arrangement of squares, to remind you of your aim in solving the puzzle. A checking routine is built into the program, and you will be informed when you have successfully solved the puzzle, and how many moves it took you. Unlike the commercial versions of this program, this version has only one level of difficulty, so once you develop a strategy for solving the puzzle, your aim must be to minimise the number of moves necessary to solve it.

This version also differs from commercial versions in that it is written entirely in BASIC. This is achieved by using the QL's enhanced BASIC facilities, particularly SCROLL and PAN in pre-defined windows. I hope that the program is sufficiently well documented to allow it to be understood without a detailed description of how it works. After all, 'readability' must be one of the aims of all programmers switching to QL's SuperBASIC.

Program Listing: Nowotnik Puzzle

```
10 REMark  The Nowotnik Puzzle
20 REMark   by David Nowotnik
30 REMark    September, 1984
40 init
50 REPeat demo_option
60 title: key_press
70 IF a$="n" THEN EXIT demo_option
80 set_up
90 shuffle
100 PAUSE 200
110 END REPeat demo_option
120 set_up: view: shuffle
130 mv=0
140 REPeat game
150 mv=mv+1
160 AT #2,0,0: PRINT #2,"Move ";mv
170 your_move
180 check
190 IF OK THEN EXIT game
200 END REPeat game
```

```
210 CLS
220 AT 2,4: PRINT "  well done!"
230 PRINT: PRINT "  you solved the puzzle"
240 PRINT "      in ";mv;" moves."
250 STOP
500 REMark ********************
510 REMark        your_move
520 REMark ********************
530 REMark
540 DEFine PROCedure your_move
550 REPeat keys
560 key_press
570 move_one= CODE (a$)-48
580 IF move_one>0AND move_one<9 THEN EXIT keys
590 END REPeat keys
600 slide_piece
610 END DEFine
700 REMark ********************
710 REMark    check
720 REMark ********************
730 REMark
740 DEFine PROCedure check
750 OK=0
760 IF box$(1)="rryy" THEN OK=OK+1
770 IF box$(2)="rryy" THEN OK=OK+1
780 IF box$(3)="ggbb" THEN OK=OK+1
790 IF box$(4)="ggbb" THEN OK=OK+1
800 IF OK=4 THEN
810 OK=1
820 ELSE OK=0
830 END IF
840 END DEFine
1000 REMark ********************
1010 REMark    init
1020 REMark ********************
1030 REMark
1040 DEFine PROCedure init
1050 MODE 256
1060 DIM box$(4,4)
1070 WINDOW #1,512,256,0,0
1080 WINDOW #2,512,256,0,0
1090 BORDER #2,20,1,1: BORDER #1,20,1,1
1100 PAPER #1,7: PAPER #2,7
1110 CLS #1: CLS #2
1120 OPEN #4, scr_312x96a100x32
1130 OPEN #5, scr_312x96a100x128
1140 OPEN #6, scr_156x192a100x32
1150 OPEN #7, scr_156x192a256x32
1160 OPEN #8, scr_156x96a256x128
1170 OPEN #10, scr_312x48a100x32
1180 OPEN #11, scr_312x48a100x80
1190 OPEN #12, scr_312x48a100x128
1200 OPEN #13, scr_312x48a100x176
1210 OPEN #14, scr_78x192a100x32
1220 OPEN #15, scr_78x192a178x32
1230 OPEN #16, scr_78x192a256x32
1240 OPEN #17, scr_78x192a334x32
1250 CSIZE #1,1,1: INK #1,3
1260 END DEFine
2000 REMark ********************
2010 REMark    title
2020 REMark ********************
2030 REMark
2040 DEFine PROCedure title
2050 REMark
2060 CLS
2070 AT #1,4,3: PRINT #1,"The Nowotnik Puzzle"
2080 AT #2,12,1: PRINT #2,"Do you want a demonstra
tion? (y/n)"
2090 END DEFine
3000 REMark ********************
3010 REMark       set_up
3020 REMark ********************
3030 REMark
3040 DEFine PROCedure set_up
3050 CLS #1
3060 PAPER #4,2: CLS #4
3070 PAPER #7,6: CLS #7
3080 PAPER #5,4: CLS #5
3090 PAPER #8,1: CLS #8
3100 AT #2,5,2: PRINT #2,"5^"
3110 PRINT #2: PRINT #2," <1"
3120 AT #2,5,32: PRINT #2, "^7"
3130 AT #2,7,32: PRINT #2, "2>"
3140 AT #2,14,2: PRINT #2,"<3"
3150 PRINT #2: PRINT #2,"  6v"
3160 AT #2,14,32: PRINT #2, "4>"
3170 AT #2,16,32: PRINT #2,"v8"
3180 FOR i=1 TO 2
3190 box$(i)="rryy"
3200 NEXT i
3210 FOR i=3 TO 4
3220 box$(i)="ggbb"
3230 NEXT i
3240 END DEFine
4500 REMark ********************
4510 REMark      key_press
4520 REMark ********************
4530 REMark
4540 DEFine PROCedure key_press
4550 a$=INKEY$(-1)
4560 END DEFine
5000 REMark ********************
5010 REMark         shuffle
5020 REMark ********************
5030 REMark
5040 DEFine PROCedure shuffle
5050 PAUSE 100
5060 FOR k=1 TO 30
5070 move_one= RND (1 TO 8)
5080 slide_piece
5090 PAUSE 50
5100 NEXT k
5110 END DEFine
5500 REMark ********************
5510 REMark      slide_piece
5520 REMark ********************
5530 REMark
5540 DEFine PROCedure slide_piece
5550 SELect ON move_one
5560 =1: num=1: move_left
5570 =2: num=1: move_right
5580 =3: num=3: move_left
5590 =4: num=3: move_right
5600 =5: num=1: move_up
5610 =6: num=1: move_down
5620 =7: num=3: move_up
5630 =8: num=3: move_down
5640 END SELect
5650 END DEFine
6000 REMark ********************
6010 REMark       move_left
6020 REMark ********************
6030 REMark
6040 DEFine PROCedure move_left
6050 LOCal i
6060 FOR i=num TO num+1
6070 a$=box$(i,1):b$=box$(i,2 TO 4)
6080 box$(i)=b$ & a$
6090 colour
6100 PAPER #(9+i),cc
6110 PAN #(9+i),-78
6120 END FOR i
6130 END DEFine
6500 REMark ********************
6510 REMark       move_right
6520 REMark ********************
6530 REMark
6540 DEFine PROCedure move_right
6550 LOCal i
6560 FOR i=num TO num+1
6570 a$=box$(i,4): b$=box$(i,1 TO 3)
6580 box$(i)=a$ &b$
6590 colour
6600 PAPER #(9+i), cc
6610 PAN #(9+i), 78
6620 END FOR i
6630 END DEFine
7000 REMark ********************
7010 REMark         move_up
```

```
7020 REMark *********************
7030 REMark
7040 DEFine PROCedure move_up
7050 LOCal i,j
7060 FOR i=num TO num+1
7070 a$=box$(1,i)
7080 FOR j=1 TO 3
7090 box$(j,i)=box$(j+1,i)
7100 NEXT j
7110 box$(4,i)=a$
7120 colour
7130 PAPER #(13+i),cc
7140 SCROLL #(13+i),-48
7150 NEXT i
7160 END DEFine
7500 REMark *********************
7510 REMark        move_down
7520 REMark *********************
7530 REMark
7540 DEFine PROCedure move_down
7550 LOCal i,j
7560 FOR i=num TO num+1
7570 a$=box$(4,i)
7580 FOR j=3 TO 1 STEP -1
7590 box$(j+1,i)= box$(j,i)
7600 NEXT j
7610 box$(1,i)=a$
7620 colour
7630 PAPER #(13+i),cc
7640 SCROLL #(13+i),48
7650 NEXT i
7660 END DEFine
8000 REMark ********************
8010 REMark          col
8020 REMark ********************
8030 REMark
8040 DEFine PROCedure colour
8050 colour_code= CODE (a$)
8060 SELect ON colour_code
8070   ON colour_code=98: cc=1
8080   ON colour_code=114: cc=2
8090   ON colour_code=121:cc=6
8100   ON colour_code=103:cc=4
8110 END SELect
8120 END DEFine
9000 REMark ********************
9010 REMark            view
9020 REMark ********************
9030 REMark
9040 DEFine PROCedure view
9050 AT #2,1,32: PAPER#2,2: PRINT#2," ";
9060 PAPER#2,6: PRINT#2, " ": AT #2,2,32
9070 PAPER#2,4: PRINT #2," ";: PAPER#2,1: PRINT #2
," "
9080 PAPER #2,7
9090 END DEFine
```

Gun Shot Joystick



From Vulcan Electronics comes a sturdy pistol grip style joystick. Joysticks tend to be a matter of personal preference but if you like this type which essentially needs a fair bit of wrist action then you could do worse than look at this one.

It has a nice solid feel, even though it appears to be made of ABS plastic, and movement is firm and positive. There are two fire buttons, one on the base and one on the top of the pistol grip stick. These fire quickly and with a definite "click" which I liked. A set of rubber suction caps are fitted to the base, so it can be stuck to a table or desk for added control.

I tried it with a selection of games and found it made a noticeable improvement in my playing, on Moon Cresta my score went from four figures to five on the first play and I even beat the built in high score! I found that after about an hour playing (don't we suffer in our efforts to review for you!) that my wrist and thumb ached, but I suppose with constant use this would cease to be a problem, anyway there is an auto fire feature on the next model up in the range.

Priced at £8.95 it is one of the best of its type, but I wouldn't like to play Decathlon with it (or any other joystick for that matter).

Grandstand

The Middlesex master ZX80 programmer Mike Hyams strikes again with a Strategy game!



ZX80 owners of the world arise. At last you can join the masses with a football management simulation. No longer will you have to endure the seven day wait between editions of "Match of the day". Grandstand, a game of strategy, takes you into the world of football wheeling and dealing.

Don't be fooled into thinking that because it's for a ZX80 it must be a poor version. Grandstand takes up over 15K when running and pulls no punches when it comes to detail. At the start of the game you can choose from any team in the four divisions plus a large selection of non-league clubs. Once you have chosen your team they are placed at the bottom of division four.

At the beginning of each session there is a pause of about a minute while the F.A. Cup first round draw is made. Each season is a major undertaking as full league tables are supported. This means 46 games in Division 4, plus any cup games played. As it will take quite some time to play even one season, now is a good time to explain saving to tape. At the beginning of each week, option 4 allows you to save the game so far to tape. After you have acknowledged that you really do want to save, place a blank tape in the cassette player (not the master copy) and start recording. Then press NEWLINE and wait about six minutes while it saves. It is advisable to save again if you are not too confident of your recorder. As the SAVE command returns the computer to command mode the program automatically stops. To restart the game, and to start a game that has been loaded from a previous session, type GOTO 600.

The F.A. Cup is present in all its glory, showing all the results even when you are no longer in the cup. At the end of each season the promotions and relegations are calculated, and if you are lucky enough to gain promotion you will find life harder the further up the divisions you go.

One last note; keep a careful eye on your bank balance. As there are no facilities for bank loans, the Board of Directors will take a very dim view of going into the red, and will not hesitate to show you the door.

IMPORTANT NOTICE: Lines 1-7 MUST be copied exactly as listed. That is, each name is nine letters long (including spaces) and is followed by a '/'. All spaces must be included, and there are no spaces after the last name on each line.

```
   1 REM LIVERPOOL/MAN. UTD./NOT
TM. F./Q. P. R. /STHAMPTON/WEST
HAM /TOTTENHAM/ARSENAL  /A. VILL
A /LUTON T. /WATFORD  /NORWICH
/LEICESTER/EVERTON  /COVENTRY /S
UNDERLND/CHELSEA  /WEST BROM/STO
KE C. /IPSWCH T./SHEFF WED/NEWCA
STLE/
   2 REM BIRMNGHAM/NOTTS CTY/WOL
VES  /MAN. CITY/GRIMSBY  /CARLI
```

```
SLE /BLACKBURN/CHARLTON /BRIGHTO
N /LEEDS U. /SHREWSBRY/BARNSLEY
/HUDDRSFLD/CARDIFF /PORTSMTH /F
ULHAM /MIDDLSBRO/C. PALACE/OLD
HAM /OXFORD U./WIMBLEDON/SHEFF
 UTD/
  3 REM DERBY CTY/SWANSEA /CAM
BRIDGE/HULL CITY/BRISTL R./WALSA
LL /BOLTON /BRADFORD /GILLING
HM/NEWPRT C./BURNLEY /MILLWALL
/WIGAN A. /ORIENT /LINCOLN /P
RESTON /BRENTFORD/BOURNEMTH/PLY
MOUTH /ROTHERHAM/YORK CITY/BRIST
L C./DONCASTER/READING /
  4 REM SCUNTHRPE/SOUTHEND /POR
T VALE/EXETER /ALDERSHOT/BLACK
POOL/TRANMERE /PETERBORO/COLCHES
TR/TORQUAY /HEREFORD /CHESTRFLD
/STOCKPORT/CREWE A. /SWINDON /B
URY /NORTHMPTN/DARLINGTN/MAN
SFIELD/ROCHDALE /WREXHAM /HALIF
AX /HARTLPOOL/CHESTER /
  5 REM CHELTENHM/GRAVESEND/GLO
UCSTER/GOSPORT /ALVECHRCH/WORKS
OP /OSWESTRY /WORKNGTON/HARROW
B./SUTTON U./MAIDSTONE/NUNEATON
/RUNCORN /ALTRINCHM/WEALDSTNE/W
ORCESTER/BATH /NORTHWICH/SCA
PBORO /KDDRMNSTR/FRICKLEY /TELFO
RD /BARNET /ENFIELD /GATESHE
AD/BOSTON /WEYMOUTH /KETTERING
/YEOVIL T./DAGENHAM /BANGOR /T
ROWBRDGE/
  6 REM TEAM NAME/
  7 REM CLEMENCE /SHILTON /NEA
L /HANSEN /OSMAN /BUTCH
ER /MCQUEEN /KENNEDY /KEEGAN
 /ROBSON /WHELAN /DALGLISH
/SOUNESS /LEE /HODDLE /R
IX /RUSH /STAPLETON/DAV
IS /WITHE /BRAZIL /CROOK
S /NICHOLAS /FRANCIS /
 10 GO TO 9000
 22 GO SUB 30
 23 FOR C=0 TO 8
 24 PRINT CHR$(PEEK(X+10*(B-1)+
C));
 25 NEXT C
 26 RETURN
 31 IF A=1 THEN LET X=16427
 32 IF A=2 THEN LET X=16651
 33 IF A=3 THEN LET X=16875
 34 IF A=4 THEN LET X=17119
 35 IF A=5 THEN LET X=17363
 36 IF A=6 THEN LET X=17687
 37 IF A=7 THEN LET X=17701
 38 RETURN
 41 IF HOME>AWAY THEN GO TO 47
 42 IF HOME=AWAY THEN GO TO 51
 43 LET P(B1)=P(B1)+3
 44 LET W(B1)=W(B1)+1
 45 LET L(B2)=L(B2)+1
 46 GO TO 55
 47 LET P(B2)=P(B2)+3
 48 LET W(B2)=W(B2)+1
 49 LET L(B1)=L(B1)+1
 50 GO TO 55
 51 LET P(B1)=P(B1)+1
 52 LET P(B2)=P(B2)+1
 53 LET D(B1)=D(B1)+1
 54 LET D(B2)=D(B2)+1
 55 LET F(B1)=F(B1)+AWAY
 56 LET A(B1)=A(B1)+HOME
 57 LET F(B2)=F(B2)+HOME
 58 LET A(B2)=A(B2)+AWAY
 59 RETURN
 101 PRINT
 102 PRINT "PRESS N/L TO SET UP
NEW SEASON"
 103 INPUT Z$
 105 RANDOMIZE
 110 FOR A=1 TO 24
 120 LET C(A)=RND(10)+10
 130 LET E(A)=RND(5)
 140 NEXT A
 150 LET MATCH=0
 200 LET M=42
 210 IF DIV=3 OR DIV=4 THEN LET
M=46
 220 FOR Q=1 TO 80
 230 LET H=RND(80)
 240 IF R(H)=-1 THEN GO TO 230
 250 LET R(H)=-1
 260 IF H>48 THEN LET H=500+H-4
8
 270 IF H<25 THEN LET H=300+H
 280 IF H>24 AND H<49 THEN LET
H=400+H-24
 290 LET G(Q)=H
 295 NEXT Q
 300 LET INCUP=1
 310 LET ROUND=1
 311 IF DIV<3 THEN LET ROUND=3
 350 FOR Q=1 TO 80
 371 IF Q>24 THEN GO TO 380
 372 LET W(Q)=0
 373 LET D(Q)=0
 374 LET L(Q)=0
 375 LET F(Q)=0
 376 LET A(Q)=0
 377 LET P(Q)=0
 378 LET Q(Q)=Q
 380 LET R(Q)=0
 390 NEXT Q
```

```
500 LET POS=0
510 LET MOR=10
520 LET UPDATE=0
530 LET CUPGAME=0
540 GO TO 1000
600 GO SUB 9960
610 GO TO 1010
1000 FOR P=1 TO M
1010 CLS
1020 PRINT "SELECT AN OPTION"
1030 PRINT
1040 PRINT "1 - SELL A PLAYER"
1050 PRINT
1060 PRINT "2 - CLUB REPORT"
1070 PRINT
1080 PRINT "3 - PERFORMANCE THIS
 SEASON"
1090 PRINT
1100 PRINT "4 - SAVE TO TAPE"
1110 PRINT
1120 PRINT "5 - MOVE ON TO MATCH
"
1130 PRINT
1140 INPUT Z
1150 IF Z<1 OR Z>5 THEN  GO TO 1
140
1155 CLS
1160 GO TO 1100+Z*100
1210 PRINT ,"SELL A PLAYER"
1220 GO SUB 9600
1240 PRINT "ENTER NO. OF PLAYER
TO SELL OR"
1250 GO SUB 9800
1255 INPUT Z
1260 IF Z<0 OR Z>24 THEN  GO TO
1255
1261 IF Z=0 THEN  GO TO 1010
1265 IF B(Z)=0 THEN  GO TO 1255
1270 CLS
1275 LET A=RND(4)
1276 LET B=RND(22)
1277 GO SUB 20
1278 PRINT " HAVE OFFERED"
1280 LET AA=5*(5-DIV)*E(Z)+RND(6
)-3
1281 PRINT
1285 PRINT "#";AA;"000 FOR ";
1287 LET A=7
1288 LET B=Z
1289 GO SUB 20
1290 PRINT
1291 PRINT "DO YOU ACCEPT THE OF
FER (Y/N)"
1292 INPUT Z$
1293 IF Z$="N" THEN  GO TO 1010
1294 IF NOT Z$="Y" THEN  GO TO 1
292
1297 LET CASH=CASH+AA
1298 LET B(Z)=0
1299 GO TO 1010
1310 PRINT "CLUB REPORT FOR ";
1311 LET A=DIV
1312 LET B=M/2+1
1313 GO SUB 20
1315 PRINT
1316 PRINT "SEASON ";SEASON
1320 PRINT "DIVISION ";DIV,"MONE
Y #";CASH;"000"
1321 PRINT "POSITION ";POS,"MORA
LE ";MOR
1331 PRINT
1335 IF ROUND=1 THEN  GO TO 1346
1336 IF INCUP=1 THEN  GO TO 1340
1337 PRINT "OUT OF F.A. CUP"
1338 GO TO 1345
1340 PRINT "THROUGH F.A. CUP ";
1341 IF ROUND<8 THEN  PRINT "ROU
ND ";ROUND-1
1342 IF ROUND=8 THEN  PRINT "SEM
I-FINAL"
1355 PRINT "▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀
▀▀▀▀▀▀▀▀▀"
1360 PRINT "CLUB PERFORMANCE FOR
 PAST","9 SEASONS"
1361 PRINT
1365 PRINT "SSN LEAGUE","CUP"
1370 FOR N=1 TO 9
1375 PRINT N;"   ";Y(N);", DIV "
;X(N),
1378 IF Z(N)<7 THEN  PRINT "ROUN
D ";Z(N)
1380 IF Z(N)=7 THEN  PRINT "S-FI
NAL"
1385 IF Z(N)=8 THEN  PRINT "FINA
LISTS"
1390 IF Z(N)=9 THEN  PRINT "***W
INNERS***"
1392 NEXT N
1395 GO SUB 9840
1399 GO TO 1010
1400 PRINT ,"CLUB PERFORMANCE"
1401 PRINT
1405 LET GAME=0
1410 FOR N=1 TO 60
1411 IF PEEK(16421)>5 THEN  GO T
O 1419
1412 PRINT
1413 GO SUB 9840
1415 CLS
1416 GO TO 1411
1419 IF R(N)=0 THEN  GO TO 1480
1420 IF R(N)>1000 THEN  GO TO 14
50
1423 LET GAME=GAME+1
```

```
1425 IF R(N)>199 THEN  PRINT "
A ";
1426 IF R(N)<200 THEN  PRINT "
H ";
1427 LET A=DIV
1428 LET B=GAME
1430 GO SUB 20
1435 LET Z=R(N)-(R(N)/100)*100
1440 PRINT " ";Z-(Z/10)*10;" - "
;
1445 LET Z=Z/10
1446 PRINT Z
1447 GO TO 1460
1450 PRINT "CUP ";
1451 LET B=R(N)/100
1452 LET A=B-(B/10)*10
1453 LET B=(B-A)/10
1455 GO TO 1430
1460 NEXT N
1460 NEXT N
1480 PRINT
1485 GO SUB 9840
1490 GO TO 1010
1500 PRINT ,"SAVE TO TAPE"
1501 PRINT
1502 PRINT "ARE YOU SURE (Y/N)"
1503 INPUT Z$
1504 IF NOT Z$="Y" THEN  GO TO 1
010
1510 PRINT
1520 PRINT "PREPARE CASSETTE PLA
YER AND THEN"
1530 PRINT
1540 GO SUB 9840
1550 SAVE
1560 STOP
1601 CLS
1605 IF CUPGAME=1 THEN  GO TO 16
19
1610 IF DIV<3 AND (P=38 OR P=33
OR P=28 OR P=23 OR P=18 OR P=13
OR P=8) THEN  GO TO 8000
1615 IF DIV>2 AND (P=42 OR P=37
OR P=32 OR P=27 OR P=22 OR P=17
OR P=12) THEN  GO TO 8000
1619 LET CUPGAME=0
1620 PRINT ,"LEAGUE MATCH"
1630 PRINT
1640 LET HME=1
1650 IF P=(P/2)*2 THEN  LET HME=
2
1660 LET DIV1=DIV
1661 LET DIV2=DIV
1670 LET B1=P
1671 IF B1>M/2 THEN  LET B1=B1-M
/2
1675 GO SUB 1680
1676 GO TO 1750
1680 LET B2=M/2+1
1685 PRINT "  ";
1690 IF HME=1 THEN  GO TO 1720
1695 LET B=B1
1696 LET A=DIV1
1700 GO SUB 20
1705 LET B=B2
1706 LET A=DIV2
1710 PRINT "  V  ";
1715 GO SUB 20
1716 GO TO 1741
1720 LET B=B2
1721 LET A=DIV2
1725 GO SUB 20
1730 PRINT "  V ";
1735 LET B=B1
1736 LET A=DIV1
1740 GO SUB 20
1741 RETURN
1750 PRINT
1760 PRINT
1761 PRINT "ENTER "1" FOR LEAGUE
 TABLE","SINCE LAST CALCULATED,
OR"
1762 GO SUB 9800
1763 INPUT Z
1764 IF Z=0 THEN  GO TO 4000
1765 IF NOT Z=1 THEN  GO TO 1763
1768 PRINT
1770 PRINT "LEAGUE DIV. ";DIV;"
AFTER ";UPDATE;" GAMES"
1780 PRINT
1785 LET M2=(M+2)/4
1790 FOR N=1 TO M2
1800 LET B=Q(N)
1801 IF N<10 THEN  PRINT " ";
1805 PRINT N;". ";
1810 GO SUB 20
1820 PRINT ,
1830 PRINT N+M2;". ";
1840 LET B=Q(N+M2)
1850 GO SUB 20
1860 PRINT
1870 NEXT N
1880 GO SUB 9840
1890 GO TO 4000
1900 FOR N=1 TO 24
1901 IF Q(N)=B1 THEN  GO TO 1903
1902 NEXT N
1903 LET TMPK=P(B1)
1904 LET EN2=RND(10)+RND(10*(TMP
K+1)/P)
1905 LET MOR2=RND(10)+RND(10*(TM
PK+1)/P)
1906 LET DEF2=RND(10)+RND(10*(TM
PK+1)/P)
```

```
1907 LET MID2=RND(1Ø)+RND(1Ø*(TM
PK+1)/P)
19ØB LET ATT2=RND(1Ø)+RND(1Ø*(TM
PK+1)/P)
191Ø CLS
1915 PRINT ,
1919 LET A=DIV2
192Ø LET B=B2
193Ø GO SUB 2Ø
194Ø PRINT " ";
195Ø LET B=B1
1955 LET A=DIV1
196Ø GO SUB 2Ø
197Ø PRINT
1975 LET EN=Ø
198Ø FOR N=1 TO 24
199Ø IF B(N)=2 THEN  LET EN=EN+C
(N)
2ØØØ NEXT N
2ØØ5 LET EN=EN/11
2ØØ7 LET DEF=Ø
2ØØ8 LET MID=Ø
2ØØ9 LET ATT=Ø
2Ø1Ø FOR N=1 TO 8
2Ø15 IF B(N)=2 THEN  LET DEF=DEF
+E(N)
2Ø2Ø IF B(N+8)=2 THEN  LET MID=M
ID+E(N+8)
2Ø25 IF B(N+16)=2 THEN  LET ATT=
ATT+E(N+16)
2Ø4Ø NEXT N
2Ø9Ø PRINT "ENERGY",EN,"   ";EN2
21ØØ PRINT "MORALE",MOR,"   ";MO
R2
211Ø PRINT "DEFENCE",DEF,"   ";D
EF2
212Ø PRINT "MIDFLD",MID,"   ";MI
D2
213Ø PRINT "ATTACK",ATT,"   ";AT
T2
214Ø PRINT
215Ø PRINT "ENTER "1" TO CHANGE
TEAM OR"
216Ø GO SUB 98ØØ
217Ø INPUT Z
218Ø IF Z=Ø THEN  GO TO 3ØØØ
219Ø CLS
22ØØ GO SUB 96ØØ
22Ø5 LET PLA=Ø
221Ø FOR N=1 TO 24
2215 IF B(N)=2 THEN  LET PLA=PLA
+1
222Ø NEXT N
223Ø IF PLA>11 THEN  GO TO 23ØØ
224Ø PRINT "ENTER PLAYER TO ADD
TO TEAM OR"
225Ø GO SUB 98ØØ
226Ø INPUT Z
2265 IF Z>24 THEN  GO TO 226Ø
227Ø IF Z<1 THEN  GO TO 191Ø
2275 IF NOT B(Z)=3 THEN  GO TO 2
26Ø
228Ø LET B(Z)=2
229Ø GO TO 219Ø
23ØØ PRINT "ENTER PLAYER TO REMO
VE"
231Ø INPUT Z
232Ø IF Z<1 OR Z>24 THEN  GO TO
231Ø
2325 IF NOT B(Z)=2 THEN  GO TO 2
31Ø
233Ø LET B(Z)=3
234Ø GO TO 219Ø
3ØØ1 LET HOME=Ø
3ØØ2 LET AWAY=Ø
3ØØ3 PRINT
3ØØ5 FOR N=1 TO RND(1Ø)+2
3ØØ6 IF N=1 THEN  GO TO 34ØØ
3Ø1Ø LET SHOT=RND(3)
3Ø2Ø IF SHOT=1 THEN  GO TO 31ØØ
3Ø25 IF SHOT=2 THEN  GO TO 35ØØ
3Ø3Ø LET GOAL=EN+MOR+ATT-EN2-MOR
2-DEF2+RND(2Ø)
3Ø45 IF GOAL<Ø THEN  GO TO 35ØØ
3Ø5Ø LET HOME=HOME+1
3Ø6Ø GO TO 34ØØ
31ØØ LET GOAL=EN2+ATT2+MOR2-EN-M
OR-DEF+RND(2Ø)
3115 IF GOAL<Ø THEN  GO TO 35ØØ
312Ø LET AWAY=AWAY+1
34ØØ LET B=B2
34Ø5 IF HME=2 THEN  LET B=B1
341Ø LET A=DIV2
3415 IF HME=2 THEN  LET A=DIV1
342Ø GO SUB 2Ø
343Ø IF HME=1 THEN  PRINT " ";HO
ME;" - ";AWAY;" ";
3435 IF HME=2 THEN  PRINT " ";AW
AY;" - ";HOME;" ";
344Ø LET B=B1
3445 IF HME=2 THEN  LET B=B2
345Ø LET A=DIV1
3455 IF HME=2 THEN  LET A=DIV2
346Ø GO SUB 2Ø
347Ø PRINT
348Ø INPUT Z$
349Ø IF PEEK(16421)<6 THEN  CLS
35ØØ NEXT N
351Ø PRINT "END OF GAME"
352Ø LET MATCH=MATCH+1
355Ø RETURN
4ØØØ GO SUB 19ØØ
4ØØ1 GO SUB 4Ø
4Ø11 FOR N=1 TO 24
```

```
4012 LET U(N)=Ø
4013 NEXT N
4018 IF HME=1 THEN  LET GATE=(5-
DIV)*P(B2)*2Ø/(P*3)+1+RND(5-DIV)
4019 IF HME=2 THEN  LET GATE=(5-
DIV)*P(B1)*2Ø/(P*3)+1+RND(5-DIV)
4Ø2Ø PRINT "GATE #";GATE;"ØØØ"
4Ø21 GO SUB 984Ø
4Ø23 CLS
4Ø25 LET R(MATCH)=1ØØ*HME+HOME+A
WAY*1Ø
4Ø3Ø PRINT "RESULTS :- DIVISION
";DIV
4Ø36 IF HOME>AWAY THEN  LET MOR=
MOR+(21-MOR)/2
4Ø37 IF HOME<AWAY THEN  LET MOR=
MOR/2
4Ø45 PRINT
4Ø5Ø LET U(B1)=1
4Ø6Ø LET U(B2)=1
4Ø7Ø IF M=46 THEN  GO TO 4Ø8Ø
4Ø75 LET U(23)=1
4Ø76 LET U(24)=1
4Ø8Ø FOR N=1 TO (M-2)/4
4Ø9Ø LET Z=RND(24)
41ØØ IF U(Z)=1 THEN  GO TO 4Ø9Ø
411Ø LET B2=Z
412Ø LET U(Z)=1
413Ø LET HOME=RND(2*P(Z)/P+4)-1
414Ø LET B=Z
415Ø GO SUB 2Ø
416Ø PRINT " ";HOME;" V ";
417Ø LET Z=RND(24)
418Ø IF U(Z)=1 THEN  GO TO 417Ø
419Ø LET B1=Z
42ØØ LET U(Z)=1
421Ø LET AWAY=RND(2*P(Z)/P+3)-1
422Ø LET B=Z
423Ø PRINT AWAY;" ";
424Ø GO SUB 2Ø
425Ø PRINT
426Ø GO SUB 4Ø
427Ø NEXT N
428Ø PRINT
429Ø PRINT "THE NEW LEAGUE POSIT
IONS TAKE   ABOUT 6Ø SECS TO CAL
CULATE.     ENTER "1" FOR NEW TA
BLE OR"
4295 GO SUB 98ØØ
43ØØ INPUT Z$
43Ø4 IF P=M THEN  GO TO 431Ø
43Ø5 IF Z$="Ø" THEN  GO TO 455Ø
43Ø6 IF NOT Z$="1" THEN  GO TO 4
3ØØ
431Ø CLS
4315 LET UPDATE=P
432Ø FOR H=1 TO M/2
433Ø FOR I=H+1 TO M/2+1
434Ø IF P(Q(H))>P(Q(I)) THEN  GO
 TO 438Ø
435Ø LET DUMMY=Q(H)
436Ø LET Q(H)=Q(I)
437Ø LET Q(I)=DUMMY
438Ø NEXT I
439Ø NEXT H
4395 LET A=DIV
4396 PRINT "TEAM          W   D
L     F    A  PT",,,,
44ØØ FOR H=1 TO M/2+1
441Ø IF NOT H=13 THEN  GO TO 443
Ø
4415 GO SUB 984Ø
442Ø CLS
4425 PRINT "TEAM          W   D
L     F    A  PT",,,,
443Ø LET B=Q(H)
4431 IF B=M/2+1 THEN  LET POS=H
4435 PRINT H;".";
4436 IF H<1Ø THEN  PRINT " ";
444Ø GO SUB 2Ø
445Ø PRINT " ";
4455 IF W(B)<1Ø THEN  PRINT " ";
446Ø PRINT W(B);"  ";
4465 IF D(B)<1Ø THEN  PRINT " ";
447Ø PRINT D(B);"  ";
4475 IF L(B)<1Ø THEN  PRINT " ";
448Ø PRINT L(B);"  ";
4485 IF F(B)<1Ø THEN  PRINT " ";
4486 IF F(B)<1ØØ THEN  PRINT " "
;
449Ø PRINT F(B);"  ";
4495 IF A(B)<1Ø THEN  PRINT " ";
4496 IF A(B)<1ØØ THEN  PRINT " "
;
45ØØ PRINT A(B);"  ";
45Ø5 IF P(B)<1ØØ THEN  PRINT P(B
)
45Ø6 IF P(B)>99 THEN  PRINT ,,,,
"    ";P(B)
451Ø NEXT H
452Ø PRINT
4525 PRINT "TABLE AFTER ";P;" GA
MES"
4526 PRINT
453Ø GO SUB 984Ø
455Ø IF HME=1 THEN  LET CASH=CAS
H+GATE*2/3
456Ø IF HME=2 THEN  LET CASH=CAS
H+GATE/3
46ØØ FOR H=1 TO 24
461Ø IF B(H)=3 OR B(H)=1 THEN  L
ET C(H)=C(H)+1Ø
4615 IF C(H)>2Ø THEN  LET C(H)=2
Ø
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4620 IF B(H)=2 THEN  LET C(H)=C(
H)-1
4624 IF (B(H)=2 OR B(H)=3) AND R
ND(40)=40 THEN  LET B(H)=1
4625 IF B(H)=1 AND RND(10)>5 THE
N  LET B(H)=3
4630 IF C(H)=0 THEN  LET B(H)=1
4640 NEXT H
4650 LET DUMMY=0
4660 FOR H=1 TO 24
4670 IF B(H)>0 THEN  LET DUMMY=D
UMMY+E(H)
4680 NEXT H
4690 LET DUMMY=(5-DIV)*DUMMY/10
4700 LET CASH=CASH-DUMMY-5+DIV
4710 CLS
4715 IF P=M THEN  GO TO 5900
4720 PRINT "TRANSFER MARKET"
4730 PRINT
4740 PRINT "CASH IN HAND :- #";
CASH;"000"
4750 PRINT
4751 LET B=0
4752 FOR H=1 TO 24
4753 IF B(H)>0 THEN  LET B=B+1
4754 NEXT H
4755 IF B<16 THEN  GO TO 4760
4756 PRINT "YOU HAVE A FULL SQUA
D"
4757 GO TO 5900
4760 LET B=RND(24)
4770 IF NOT B(B)=0 THEN  GO TO 4
760
4780 LET A=7
4785 PRINT B;". ";
4790 GO SUB 20
4795 PRINT
4796 PRINT
4800 PRINT "ENERGY :- ";C(B)
4810 PRINT "SKILL  :- ";E(B)
4820 PRINT
4830 PRINT "DO YOU WANT THIS PLA
YER ?","Y/N"
4840 INPUT Z$
4850 IF Z$="N" THEN  GO TO 5900
4860 IF NOT Z$="Y" THEN  GO TO 4
840
4870 LET GATE=E(B)*(5-DIV)*5
4880 PRINT
4890 PRINT "YOU HAVE PAID #";GA
TE;"000"
4900 LET CASH=CASH-GATE
4950 LET B(B)=3
5000 GO SUB 9840
5900 IF CASH>-1 THEN  GO TO 6000
5910 CLS
5920 PRINT "THE CLUB OWES #";AB
S(CASH);"000"
5930 PRINT
5940 PRINT "A NEW BOARD OF DIREC
TORS HAVE"
5950 PRINT
5960 PRINT "TAKEN OVER , AND YOU
 HAVE BEEN"
5970 PRINT
5980 PRINT "SACKED ";
5990 GO TO 5980
6000 IF CUPGAME=1 THEN  GO TO 10
10
6010 NEXT P
6110 GO TO 8000
6120 PRINT "PRESS N/L FOR END OF
 SEASON","RESULTS"
6130 INPUT Z$
6140 LET SET=0
6150 CLS
6201 IF DIV=1 THEN  GO TO 6400
6205 LET I=3
6206 IF DIV=4 THEN  LET I=4
6208 PRINT "PROMOTED"
6209 PRINT
6210 FOR H=1 TO I
6215 LET A=DIV
6220 LET STDIV=DIV
6225 LET STTM=Q(H)
6227 LET B=STTM
6228 GO SUB 20
6229 PRINT
6230 LET FINDIV=DIV-1
6235 LET FINTM=17+H
6240 IF Q(H)=M/2+1 THEN  LET FIN
TM=22
6245 IF DIV=4 AND Q(H)=M/2+1 THE
N  LET FINTM=24
6246 IF STTM=M/2+1 THEN  LET SET
=-1
6250 GO SUB 9300
6260 NEXT H
6400 IF DIV=4 THEN  GO TO 6600
6401 PRINT
6402 PRINT
6403 PRINT "RELEGATED"
6404 PRINT
6410 LET I=3
6420 IF DIV=3 THEN  LET I=4
6425 LET GATE=M/2+2
6430 FOR H=1 TO I
6435 LET A=DIV
6440 LET STDIV=DIV
6450 LET STTM=Q(GATE-H)
6455 LET B=STTM
6456 GO SUB 20
6457 PRINT
6460 LET FINDIV=DIV+1
```

```
6470 LET FINTM=H
6480 IF STTM=M/2+1 THEN  LET FIN
TM=22
6485 IF DIV=3 AND STTM=M/2+1 THE
N  LET FINTM=24
6486 IF STTM=M/2+1 THEN  LET SET
=1
6490 GO SUB 9300
6500 NEXT H
6600 LET H=9
6610 LET X(H)=X(H-1)
6620 LET Y(H)=Y(H-1)
6630 LET Z(H)=Z(H-1)
6640 LET H=H-1
6650 IF H>1 THEN  GO TO 6610
6660 LET X(1)=DIV
6670 LET Y(1)=POS
6680 LET Z(1)=RNDOUT
6690 LET DIV=DIV+SET
6695 LET SEASON=SEASON+1
6700 GO TO 100
7999 STOP
8000 LET I=2**
(9-ROUND)
8001 IF ROUND<3 THEN  LET I=(3-R
OUND)*40
8002 IF DIV<3 AND ROUND<3 THEN
GO TO 8500
8004 IF INCUP=1 THEN  GO TO 8010
8005 GO SUB 8200
8006 PRINT "YOU ARE NOT IN THE C
UP."
8008 GO TO 8500
8010 LET HME=-1
8020 FOR H=1 TO 80
8025 LET HME=-HME
8030 IF NOT G(H)/100=DIV THEN  G
O TO 8060
8040 IF NOT G(H)-(G(H)/100)*100=
M/2+1 THEN  GO TO 8060
8050 GO TO 8100
8060 NEXT H
8100 IF HME=-1 THEN  LET HME=2
8110 LET B2=M/2+1
8120 LET DIV2=DIV
8125 IF HME=2 THEN  GO TO 8150
8130 LET DIV1=G(H+1)/100
8135 LET B1=G(H+1)-DIV1*100
8140 GO TO 8185
8170 LET DIV1=G(H-1)/100
8180 LET B1=G(H-1)-DIV1*100
8185 GO SUB 8200
8190 GO TO 8250
8200 PRINT ,"FA CUP ";
8210 IF ROUND<7 THEN  PRINT "ROU
ND ";ROUND
8220 IF ROUND=7 THEN  PRINT "SEM
I-FINAL"
8230 IF ROUND=8 THEN  PRINT "FIN
AL"
8240 PRINT
8245 RETURN
8250 GO SUB 1680
8260 PRINT
8265 PRINT
8270 PRINT "ENTER "1" FOR THE FU
LL DRAW OR"
8280 GO SUB 9800
8290 INPUT Z
8300 IF Z=0 THEN  GO TO 8400
8310 IF NOT Z=1 THEN  GO TO 8290
8315 PRINT
8335 LET H$=" "
8336 LET A$=" "
8340 FOR H=1 TO I
8341 IF (H/2)*2=H THEN  GO TO 83
85
8342 IF PEEK(16421)>5 THEN  GO T
O 8385
8343 PRINT
8344 GO SUB 9840
8345 CLS
8346 GO TO 8385
8350 LET A=G(H)/100
8360 LET B=G(H)-A*100
8370 GO SUB 20
8375 IF NOT (H/2)*2=H THEN  PRIN
T " ";H$;" V ";A$;" ";
8380 IF (H/2)*2=H THEN  PRINT
8384 RETURN
8385 GO SUB 8350
8390 NEXT H
8395 PRINT
8396 GO SUB 9840
8400 LET TMPK=(5-DIV1)*P
8410 GO SUB 1904
8415 LET GATE=ROUND*5+RND(5*ROUN
D)
8416 PRINT "GATE #";GATE;"000"
8417 LET CASH=CASH+GATE
8418 PRINT
8419 LET R(MATCH)=B1*1000+DIV1*1
00+HOME+AWAY*10
8420 IF HOME>AWAY THEN  GO TO 84
90
8430 IF HOME=AWAY THEN  GO TO 84
60
8440 LET INCUP=0
8441 LET RNDOUT=ROUND
8445 LET MOR=MOR/4
8450 GO TO 8500
8460 PRINT "REPLAY TO FOLLOW :-"
8465 GO SUB 9840
8470 GO TO 8400
```

```
8490 LET MOR=MOR+(21-MOR)/2
8495 IF ROUND=8 THEN LET RNDOUT
=9
8500 LET DUMMY=M/2+1+DIV*100
8505 GO SUB 9840
8506 CLS
8507 GO SUB 8200
8508 PRINT ,"   RESULTS"
8509 PRINT
8510 FOR H=1 TO I
8515 IF PEEK(16421)<5 THEN GO S
UB 9840
8516 IF PEEK(16421)<5 THEN CLS
8520 IF DUMMY=G(H) OR DUMMY=G(H+
1) THEN GO TO 8600
8530 LET H$=STR$(RND(7-G(H)/100)
-1)
8540 LET A$=STR$(RND(7-G(H+1)/10
0)-1)
8550 IF A$=H$ THEN GO TO 8530
8560 GO SUB 8350
8570 LET H=H+1
8580 GO SUB 8350
8590 GO TO 8630
8600 LET A$=STR$(AWAY)
8605 LET H$=STR$(HOME)
8610 IF HME=2 THEN LET A$=STR$(
HOME)
8615 IF HME=2 THEN LET H$=STR$(
AWAY)
8620 GO TO 8560
8630 IF H$>A$ THEN LET G(H/2)=G
(H-1)
8640 IF H$<A$ THEN LET G(H/2)=G
(H)
8650 NEXT H
8660 LET ROUND=ROUND+1
8670 IF NOT ROUND=3 THEN GO TO
8780
8675 FOR H=1 TO 22
8680 LET G(H+20)=100+H
8685 LET G(H+42)=200+H
8690 NEXT H
8700 FOR H=1 TO 30
8710 LET A=RND(64)
8720 LET B=RND(64)
8730 IF A=B THEN GO TO 8710
8740 LET DUMMY=G(A)
8750 LET G(A)=G(B)
8760 LET G(B)=DUMMY
8770 NEXT H
8780 LET CUPGAME=1
8790 GO SUB 9840
8800 IF RNDOUT<9 THEN GO TO 885
0
8810 FOR H=1 TO 20
8820 PRINT "WINNERS ";
8830 NEXT H
8840 GO SUB 9840
8850 IF ROUND=9 THEN GO TO 6120
8900 GO TO 4600
9000 DIM W(24)
9001 DIM D(24)
9002 DIM L(24)
9003 DIM F(24)
9004 DIM A(24)
9005 DIM P(24)
9006 DIM B(24)
9007 DIM C(24)
9008 DIM E(24)
9009 DIM G(80)
9011 LET CASH=100
9012 DIM X(9)
9013 DIM Y(9)
9014 DIM Z(9)
9015 DIM Q(24)
9016 LET SEASON=1
9017 DIM R(80)
9018 DIM U(24)
9050 GO SUB 9960
9100 LET DIV=4
9110 FOR A=1 TO 5
9115 CLS
9120 PRINT "PICK A TEAM BY NUMBE
R OR"
9121 GO SUB 9800
9125 LET M=22
9126 IF A=3 OR A=4 THEN LET M=2
4
9127 IF A=5 THEN LET M=32
9130 PRINT
9140 FOR B=1 TO M
9149 IF B<10 THEN PRINT " ";
9150 PRINT B;" ";
9160 GO SUB 20
9170 PRINT ,
9180 NEXT B
9190 PRINT
9210 INPUT Z
9220 IF Z>0 AND Z<M+1 THEN GO T
O 9250
9230 NEXT A
9240 GO TO 9110
9250 LET STDIV=A
9255 LET STTM=Z
9260 LET FINDIV=4
9265 LET FINTM=24
9270 GO SUB 9300
9280 GO TO 9500
9300 LET A=STDIV
9310 LET B=STTM
9320 LET C=6
9330 LET D=1
9340 GO SUB 9950
```

```
9350 LET A=FINDIV
9360 LET B=FINTM
9370 LET C=STDIV
9380 LET D=STTM
9390 GO SUB 9950
9400 LET A=6
9410 LET B=1
9420 LET C=FINDIV
9430 LET D=FINTM
9440 GO SUB 9950
9450 RETURN
9500 LET M=24
9510 RANDOMIZE
9520 FOR A=1 TO 12
9530 LET B=RND(24)
9535 IF B(B)>0 THEN  GO TO 9530
9540 LET B(B)=2
9545 NEXT A
9550 LET B=RND(24)
9555 IF B(B)=0 THEN  GO TO 9550
9560 LET B(B)=3
9580 GO TO 100
9600 CLS
9601 PRINT ,"TEAM PLAYERS"
9607 PRINT " I=INJURED  P=PLA
YING"
9609 PRINT "NO   NAME","SKL EGY
STATUS"
9619 LET A=7
9620 FOR B=1 TO 24
9630 IF B(B)=0 THEN  GO TO 9660
9635 IF B<10 THEN  PRINT " ";
9636 PRINT B;". ";
9640 GO SUB 20
9645 PRINT ,E(B);"   ";C(B),"  "
;
9646 IF B(B)=1 THEN  PRINT "I"
9647 IF B(B)=2 THEN  PRINT "P"
9648 IF B(B)=3 THEN  PRINT
9660 NEXT B
9670 RETURN
9800 PRINT "ENTER "0" TO CONTINU
E"
9810 RETURN
9840 PRINT "PRESS N/L TO CONTINU
E"
9850 INPUT Z$
9860 RETURN
9952 GO SUB 30
9953 LET AA=X
9954 LET A=C
9955 GO SUB 30
9956 FOR E=0 TO 8
9957 POKE X+(D-1)*10+E,PEEK(AA+(
B-1)*10+E)
9958 NEXT E
9959 RETURN
9960 CLS
9961 LET A$=CHR$(128)
9962 LET B$=CHR$(136)
9963 PRINT ,,"          ";B$;"    ▚"
9964 PRINT ,,"        ▌   ▚"
9965 PRINT ," ▄▄▄▄▄▄▄","          ";C
HR$(130);"     ";B$
9966 PRINT ,"▞     ▖";CHR$(131);"
▄","▌      ";A$;"▖"
9967 PRINT "          ▗▚       ";CHR$(
132);"  ▌","▚     ";A$;A$;"▖"
9968 PRINT "         ▞ ▚   ";CHR$(1
32);A$;"▌  ▚","  ";B$;"   ";CHR$(1
32);A$;A$;A$
9969 PRINT "          ▌   ▚▄";A$;A$;A
$;A$;"▖▄";B$," ";CHR$(130);"▄";A
$;A$;A$;A$;CHR$(135)
9970 PRINT "         ▞     ";A$;A$;A$
;A$;A$;A$;" ";CHR$(130)," ";A$;A
$;A$;A$;A$;CHR$(135)
9971 PRINT "        ";CHR$(130);"
  ";A$;A$;A$;A$;A$;CHR$(135);"
▌",CHR$(132);A$;A$;A$;A$;A$
9972 PRINT "        ";CHR$(130);"
  ";A$;A$;A$;A$;A$;"▌  ▌    ";CH
R$(130);A$;A$;A$;A$;A$;"▘"
9973 PRINT "        ";CHR$(130);"
 ▄";A$;A$;A$;A$;A$;"▖  ▌    ";A$
;A$;A$;A$;A$;"▘"
9974 PRINT "        ";CHR$(130);" ▄▄
";CHR$(131);"          ";CHR$(130);"
 ▞    ▖";A$;A$;A$;A$;"▘"
9975 PRINT "         ";B$,,CHR$(135
);"      ";CHR$(130);A$;A$;A$;"▘"
9976 PRINT "          ";B$;"  ▄▄
▞      ";CHR$(130);A$;A$;CHR$(13
5)
9977 PRINT ,CHR$(131);"▄";CHR$(1
32);A$;A$;CHR$(135);CHR$(131);"
 ";B$;"     ▘";A$;CHR$(135);"▘"
9979 PRINT ,"  ▘";CHR$(131),"  "
;B$;"    ";CHR$(131)
9980 PRINT ," ";B$,"   ";B$
9981 PRINT ,"   ";B$,"     ";B$;"
▖"
9982 PRINT ,"    ";B$,"      ▀"
9983 PRINT " GRANDSTAND  ";B$;"▖
"
9984 PRINT " ▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒   ▘";B$;
"▖"
9985 PRINT "  A GAME OF STRATEGY
"
9986 PRINT
9987 INPUT Z$
9988 RETURN
9999 PRINT PEEK(16396)+PEEK(1639
7)*256
```

■

The Binatone Data Recorder

This issue we have half a dozen of Binatone's new Data Recorders to give away!



A few weeks ago a young lady came to the ZX office, laden with bulky looking carrier bags.

"Oh my gawd," we all cried. "not another tape recorder to review?" But it was, of course. However, this particular unit turned out to be really rather good, and so, when we received a 'phone call from the people at Binatone asking — "How would you like to run a competition with the Data Recorder as a prize?" — we jumped at the chance, so we now have six of these fine units to give to our readers, regardless of which machine you own.

The Review

But first, we'll let you hear what our reviewer said when we sent him the recorder to look at.

"From Binatone comes their contribution to the computer industry. This recorder is an impressive looking unit which is rather large and the cassette housing is upright while the keys form a ledge at right angles at the bottom of it.

The whole unit is almost square and as well as the usual Play/Record/F.forward/Rewind/Stop/Pause keys tape counter, monitor switch and power switch are mounted on the front panel.

On the left hand side are the ear and mic sockets — marked "output/load" and "input/save" — a remote socket and a sliding volume control (output/load level). Also on this panel is a phase switch which gives normal or reverse phasing to the output, as far as I can tell this has no effect on the loading of spectrum programs.

A serious omission is that no provision for adjusting the head azimuth has been made, this is usually a small hole for inserting a screwdriver, a quick twiddle of which has loaded many a reluctant program, however, Binatone assure us that they would be happy to adjust any units which seem to have alignment problems.

The instruction booklet is well produced and you'd have to be a complete idiot to misunderstand it. I tried it with a variety of tapes, some old and some new and all bar one loaded successfully, then I tried it with a program which had failed to load on all my other recorders, and, surprise, surprise it loaded first time!

At £29.95 it is by no means cheap, but it looks very impressive and has performed admirably. I would recommend it to anyone who feels that it is worth getting a dedicated recorder for their computer."

For what it's worth, I can also add that the recorder has been more or less adopted for use in our offices when we want to try out software.

The Competition

Somewhere on these two pages you will see a small captionless cartoon featuring (among other things) a tape recorder. All you have to do to win one of the Binatone recorders is to supply an absolutely hilarious caption to accompany the cartoon. The captions should be 'suitable for mass consumption' i.e. not too disgusting. Other than that, you can do what you want.

To Enter

Entries should be written either on a postcard, or the back of an envelope.

The rules

- This competition is open to all UK and Northern Ireland readers of *ZX Computing*, except employees of Argus Specialist Publications Ltd, their printers and distributors, employees of Binatone and anyone else associated with the competition. As long as each entry is sent on an individual envelope/postcard, there is no limit to the number of entries from each individual.
- All entries must be postmarked before 31st July 1985. The prizes will be awarded to the six entrants who provide the best captions to accompany our cartoon. No correspondence will be entered into with regard to the results, and it

is a condition of entry that the Editor's decision is final.

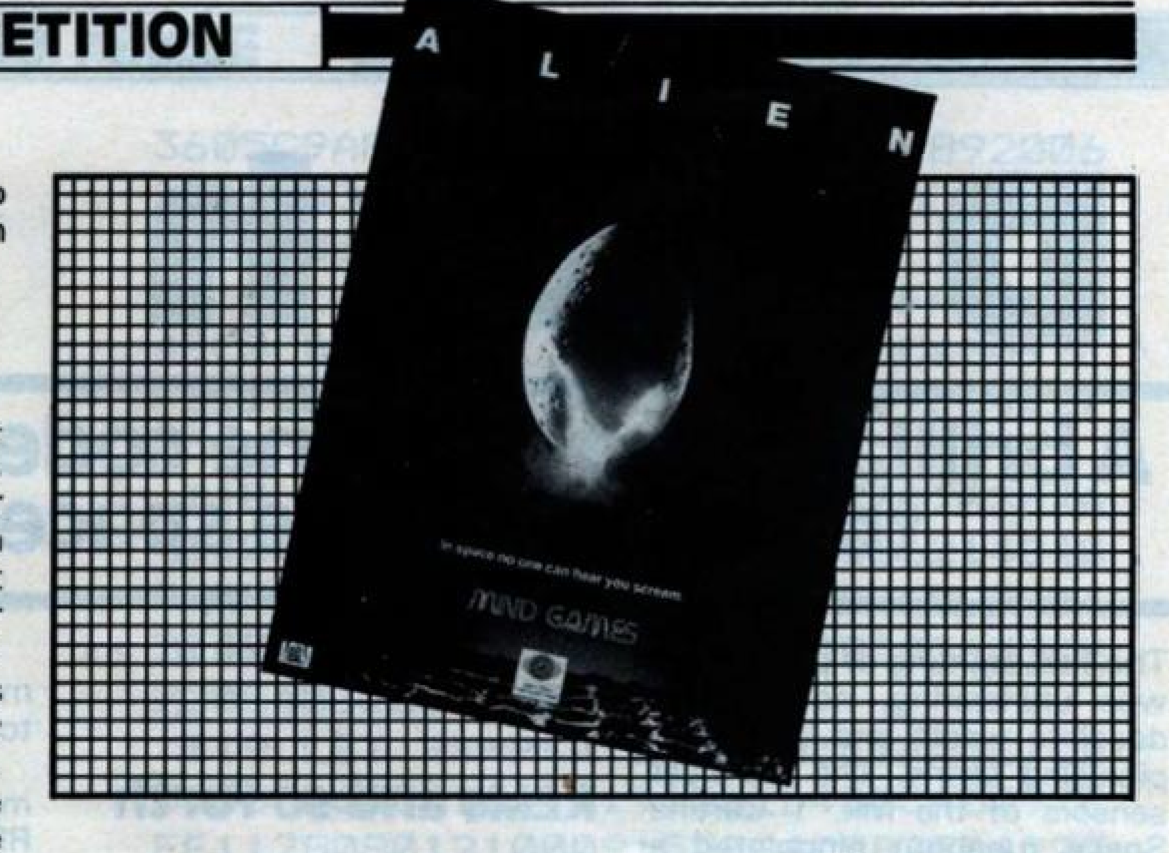
• The winners will be notified by post and the results published in a future issue of *ZX Computing.*

Temptation competition

The winners of this competition (their names were published last issue), should by now have received their prizes, as Temptation have written to us to confirm that the prizes were sent out. The people at Temptation tell us that they are surprised by the immortality of the ZX81, and as a result have now released a triple-pack of ZX81 games. Hopefully we will be able to carry a full review elsewhere in this issue.

Unique

The bad news is that Unique appear to have bitten the dust, leaving the winners of their Sandscorcher competition prizeless. The good news is that ZXC has managed to arrange for alternate prizes to be sent out. The kind people at Argus Press Software have offered to supply us with copies of their game, Alien, which has received some rather good reviews in some other mags. The only reason we haven't reviewed it yet is that Ray's, ahem, 'distressed condition' and a change in some of our review team has thrown a bit of a spanner into the works. The prizes should have arrived as you read this. We hope all the winners enjoy them, and we apologise for their having to wait such a long time.





Thurnall Disc Drive Winner

And now, the moment you've all been waiting for, the announcement of the winner of the Thurnall Disc Drive. This incredibly lucky person is none other than: Alan Smith, of Basingstoke.

The drive should have reached you by the time you read this, and we hope you enjoy it.

Software Farm

As I write this, our April/May issue has only just hit the newstands, but entries for the Software Farm competition are already staring to come in. We will of course, announce the winners in our next issue.

Next time around, with a little luck, we hope to be able to offer you the chance to win a wonderful colour monitor for use with the Spectrum. Don't say we aren't good to you! ■

Death Caves

A brilliant and machine code game from Stephen Ives to test would be spaceship pilots in Essex.

The first sighting of planet ASP was uninspiring, nothing but desolate waste and litter from picnicing aliens. The the heat sensors of the Mk. 1 Cortina Space runabout pinpointed a small entrance leading into the depths of the planet.

Being a Wonderfully Alert Life Loving Yobbo (Wally for short) I pointed my go-faster striped bonnet towards it and floored the pedal.

Fancy the inhabitants being unfriendly!

Just because our golfball team supporters destroyed a planet or two during the last interplanetary cup season there's no need to take it out on the average tourist!

And wouldn't you know it, my darn fuel tanks have started leaking! Still all I've got to do is shoot their fuel tanks so the ships' built in fuel absorbers can collect it, and simply dodge their missiles — should be easy....!

REMs and so forth

Machine code is always a source of problems so great care must be taken over this program. I can assure you it's worth it! Enter the whole program, saving at regular intervals, and making sure that each of the REM lines 1 to 22 contain 32 characters — these often include quarter characters found on keys 1 to 4.

Line 50 MUST contain 600 characters, as this is where the machine code will be stored once you have entered this type PRINT PEEK 17350 newline and the answer should be the code of the character you used (ie if you used 600 zeros then the number should be 28). If this is not so then check the REMs carefully.

Lines 100 to 160 contain the machine code and the program to load it into line 50 REM.

Lines 200 to 7030 is the main program, and line 9999 REM is also important.

Making quite sure that you have copies on tape, RUN the program. After a few minutes the program should stop with error report 9/129.

Now for the big test

Type RUN 200, newline. To the prompt for SPEED try 30, hopefully you will be battling for survival! If this is the case now remove one at a time (by typing the line number and newline) all the lines 104 to 160.

SAVE your final program two or three times by typing GOTO 8000 newline, and relex!

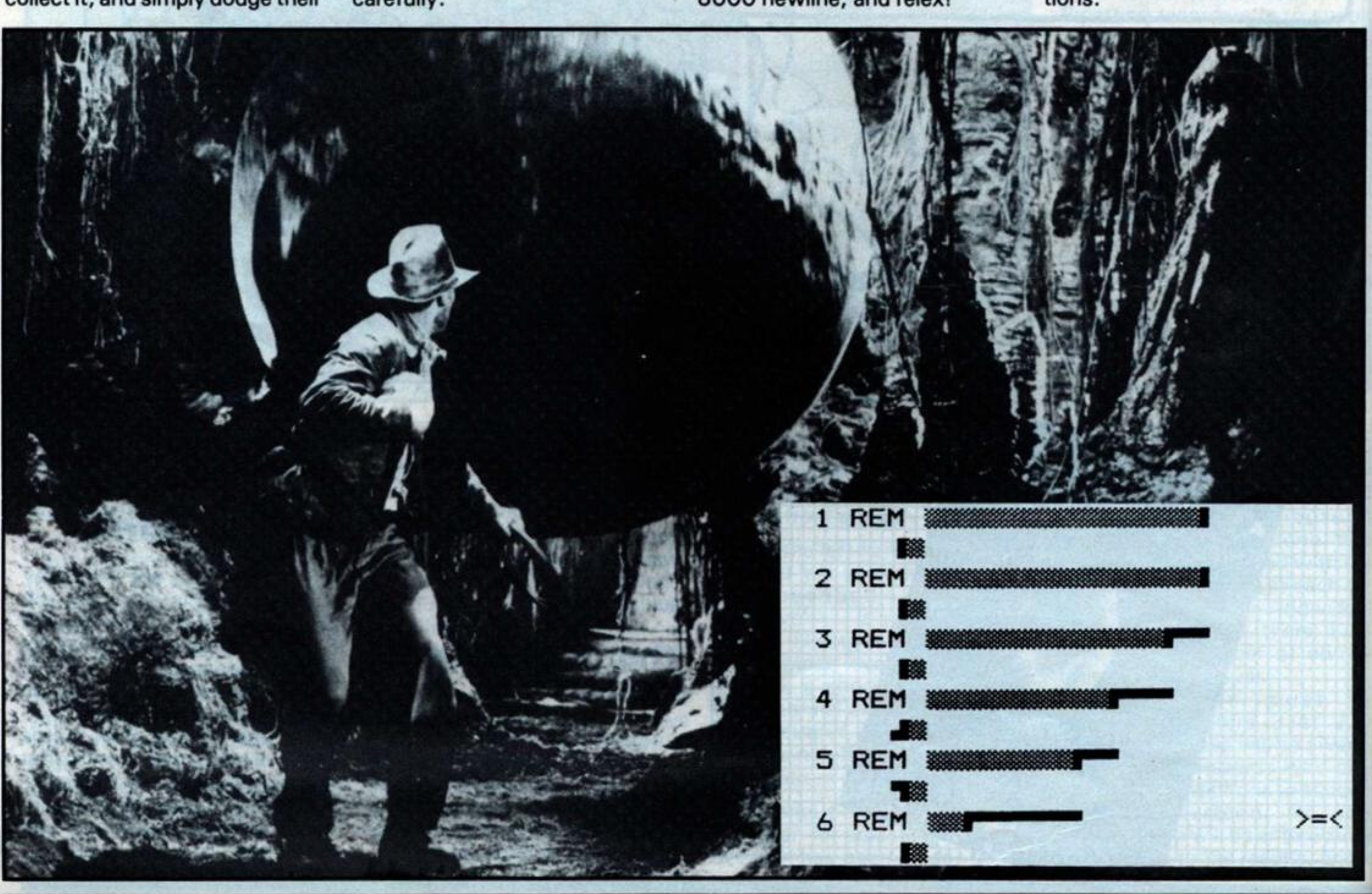
If it goes wrong

If the program crashes at any stage, reload it and check the following lines:

- 100-125 and 1001-3016 if it crashes immediately without producing any display.
- 111 if it crashes when you move.
- 114 if it crashes when you fire.
- 121 if it crashes when you hit a fuel dump.
- 116-119 if it crashes when a () appears.

Ammendments

You can redesign the cave by changing the patterns in REM lines 1 to 22 but each line must have 32 characters and the two () must remain in the same positions.



```
7 REM        >=< >=<
8 REM        >=<
9 REM
10 REM
11 REM
12 REM
13 REM
14 REM
15 REM
16 REM
17 REM
18 REM        ()
19 REM        ()
20 REM
21 REM
22 REM
50 REM THIS LINE MUST CONTAIN
   600 CHARACTERS FOR THE
   MACHINE CODE.
100 LET A=17350
104 REM SCROLL ROUTINE
105 LET P$="ED5B0C402121001901D
602EDB02A0C4001B60209EB2A4040012
000EDB07CFE43200C7DFEC0200721824
0224040C901060009224040C9"
107 REM MOVE ROUTINE
111 LET P$=P$+"ED4B0C4021FA0009
223C402A3C40012100AFED42220E40D7
D7D72A3C403A2540FEEF200123FEF720
012B0603E57EFE002807E12142403605
C92310F1E1220E403E06D73E89D73E86
D7223C40C9"
112 REM FIRE ROUTINE
114 LET P$=P$+"3A2140FE00281321
25403EDFBE280B2A3C4001220009223E
40C921214036002A3E40012100B7ED42
220E403E00D701420009223E40220E40
2A0E407EFE14200621434036 05C9FE00
20043E1BD7C921214036052A3C400122
0009223E40C9"
115 REM ENEMYS FIRE GET POS
116 LET P$=P$+"3A4440FE00203B2A
4540012100AFED427EFE0E2806214440
3605C9AF220E40D7B7ED427EFE892006
2142403605C9FE002806214440 3605C9
220E403E0ED7224540C9"
117 LET P$=P$+"2A34403E0FA467CB
4EC0CB66C01611218E00ED4B0C40097E
FE112808012100091520F4C9B7ED4222
4540360E2144403600C9"
118 LET P$=P$+"3A4840FE00203B2A
4940012100AFED427EFE0E2806214840
3605C9AF220E40D7B7ED427EFE892006
2142403605C9FE002806214840 3605C9
220E403E0ED7224940C9"
119 LET P$=P$+"2A34403E0FA467CB
56C0CB6EC01611219100ED4B0C40097E
FE112808012100091520F4C9B7ED4222
4940360E2148403600C9"
120 REM IF FUEL DUMP HIT
121 LET P$=P$+"21434036002A3E40
012100B7ED427EFE14280109 2B060336
002310FB011E000906033600 2310FB2A
4B4001960009224B40C9"
122 REM FUEL DEC    CHECH
123 LET P$=P$+"2A4B407CFE00200B
7DFE002006214240 3605C9010A00B7ED
42224B40C9"
124 REM DRIVER  17886
125 LET P$=P$+"CDC643CDC1453A42
40FE05C8CD07443A4240FE05C8CD4944
3A4340FE05CC8F45CDA744CD1B452A4D
402B7CB520FB2A4F4023224F40C3DE45
"
129 IF P$="" THEN STOP
130 POKE A,CODE P$*16+CODE P$(2
)-476
140 LET A=A+1
150 LET P$=P$(3 TO )
160 GOTO 129
195 REM
196 REM
197 REM
200 REM START OF PROGRAM
201 REM
202 REM
203 REM
210 PRINT AT 0,11;"DEATH CAVES"
220 PRINT AT 1,11;"           "
230 PRINT AT 2,0;"YOU MUST STEE
R YOUR CRAFT -     THROUGH THE C
AVES DODGEING THE WALLS AND ENEM
Y FIRE."
240 PRINT AT 6,0;"YOU MUST ALSO
 COLLECT FUEL BY    SHOOTING THE
 FUEL DUMPS - >=<    IF YOU RUN OU
T OF FUEL YOU GET  KILLED."
245 PRINT AT 11,0;"THE DEEPER Y
OU GO THE HIGHER      YOUR SCORE"
250 PRINT AT 14,0;"KEYS"
260 PRINT AT 15,0;"    "
270 PRINT AT 16,0;"""5"" MOVES
```

```
SHIP LEFT."
 280 PRINT AT 17,0;"""8"" MOVES
YOU RIGHT."
 290 PRINT AT 18,0;"""U"" FIRES
LASER BEAM."
 300 PRINT AT 21,0;"ENTER SPEED
0(FAST) TO 200(SLOW)"
 310 INPUT SPEED
 999 LET A$="                     
                                  
                 "
1000 CLS
1001 POKE 16461,255
1002 POKE 16462,SPEED
1010 POKE 16450,0
1020 POKE 16417,5
1030 POKE 16452,5
1050 POKE 16459,200
1060 POKE 16418,0
1065 POKE 16463,0
1066 POKE 16464,0
1070 PRINT AT 22,0;"          DE
ATH CAVES            "
1080 PRINT AT 23,0;"          BY
STEPHEN IVES         "
1085 POKE 16418,2
1090 PRINT AT 0,0;
2000 RAND USR 17404
3000 POKE 16448,130
3010 POKE 16449,64
3015 REM CALL M.C. DRIVER
3016 RAND USR 17886
4005 IF (PEEK 16459+256*PEEK 164
60)<>0 THEN GOTO 5000
4010 CLS
4020 PRINT AT 10,0;"YOU RAN OUT
OF FUEL"
4030 GOTO 7000
5000 CLS
5010 PRINT AT 10,0;"YOU WERE DES
TROYED "
5020 GOTO 7000
7000 PRINT AT 12,0;"YOU SCORED "
;(PEEK 16463+256*PEEK 16464)*10
7010 PRINT AT 14,0;"PRESS ""T""
TO PLAY AGAIN"
7020 IF INKEY$<>"T" THEN GOTO 70
20
7021 POKE 16418,2
7022 CLS
7030 GOTO 200
8000 SAVE "DEATH CAVES"
8010 RUN 200
9999 REM ▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒
```

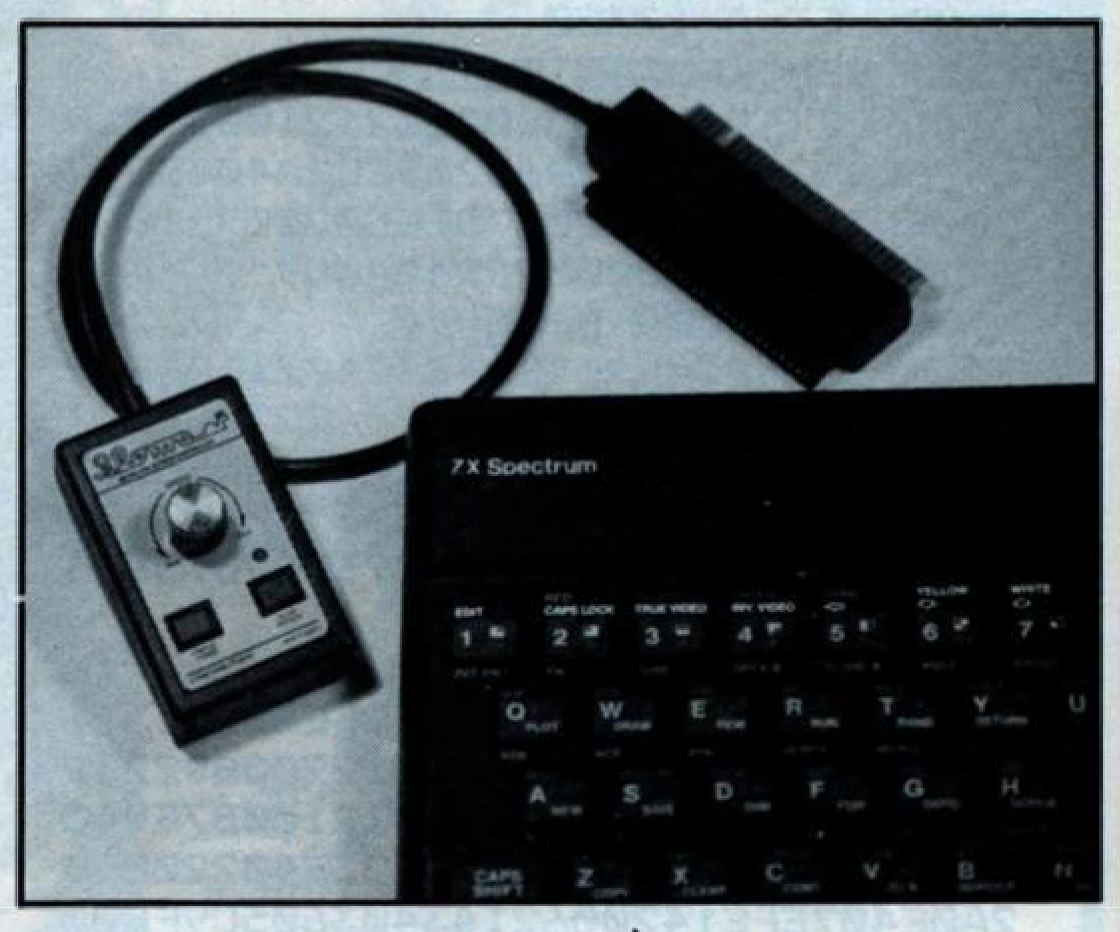
Slomo

Tired of being unable to play those fast games, or do you wish to take screen shots, or just stop a game that has no "pause"? Then Nidd have the answer to your problem — the "Slomo". It is a handy small unit comprised of sloped hand control 2.75" by 1.75", and a yard of cable leading to a user port extender which can be attached to the computer or behind any peripheral which has a suitable extender.

As with all "add-ons", it is essential to switch the computer off when fitting the "Slomo", which can then be left permanently plugged in. The instruction sheet offers a simple test program involving filling the screen with asterisks and then pressing "Freeze Frame". The screen should stand still until the button is released. Pressing the "Slow Motion" button should cause the red indicator to light, and allow the speed control knob to be turned anticlockwise to slow the screen display to a standstill. Turning the knob clockwise results in the display gradually speeding up to virtually normal speed at full turn. Press "Slow Motion" again and the light goes out showing that the "Slomo" is switched off.

When LOAD ing or SAVEing a program the device must be switched off, otherwise nothing will happen. Load one of those games that require fast reactions — such as "Bug-Eyes", "Leapfrog" or "Bruce Lee" — switch on "Slomo", select the speed that you feel able to cope with and sit back to enjoy the game as never before. When the game becomes too easy at that speed, just turn the knob slightly and play it faster. You should soon find yourself playing it at normal speed.

The only minor irritation — perhaps caused by having a Disk Drive and an FDS keyboard — is that occasionally programs have crashed after using the "Freeze Frame" button — which can be most frustrating, especially considering the time some programs take to LOAD. That aside, the "Slomo" is a valuable addition to any computer buff's armoury of peripherals.



The Slomo costs £14.95, and is available from Nidd Valley Micro Products, Stepping Stones House, Thistle Hill, Knaresborough, North Yorkshire.

Building An Adventure Brain — Part 2

Continuing his guide to Adventure writing. Brian Robb introduces some special subroutines.

In the first article of this series I began to explain how to build an adventure 'brain'. To complete this brain, several specialised subroutines are needed and it is these subroutines which I shall consider in this article.

To start with, after initialising the verbs (as shown in the previous article), the objects to be used within the adventure have to be initialised in the same way. Figure one shows a listing which does this and matches figure five accompanying the last article. Figure two shows the Spectrum version. The objects used in these listings are only examples and should be replaced with the objects you will be using in your own adventure. The number which follows each object is the location number where that object will first be encountered by the player (and this will change as the game proceeds and objects are moved around).

It is necessary on the Spectrum, but not on the ZX81, to have a program module which reads both the verb and object data into the computer's memory. Figure three shows this routine.

Now that the computer has a list of objects, a program module needs to be added to the location description printing routine to print out the object's name, along with the room description, if the player should walk into a room containing an object. Figure four shows this self explanatory routine for both the ZX81 and Spectrum, and almost completes the central brain program.

A final routine is needed for the brain program to use the verbs and to direct the computer to the specific subroutine which deals with that verb. Figure five shows this routine for both Sinclair computers.

In the first article of this series, X$ held the player's verb input and V$ the verbs that the computer understands. This module compares the first three letters of the player's input with the first three letters of all the known verbs, and, if a match is found then the computer jumps to the subroutine represented by V(N), the program line number where the subroutine begins. If no match is found the computer then prints 'I CAN'T';X$, and the player must rephrase his command until he finds a verb that the computer understands. The number of these verbs depends upon the size of your adventure and the memory available to you. To illustrate how this adventure game system works, I shall explain four necessary subroutines.

Vocabulary

To start with, I shall consider one of the most common adventuring verbs — TAKE. Figure six shows the complete module to which the computer is directed, and I shall explain how this module works.

As an example I shall assume that the player is in location five, where a knife is to be found. The player types 'TAKE KNIFE', which is split into X$: 'TAKE'; and Y$: 'KNIFE'. 'TAKE' is verb number two and 'KNIFE' is object number one, found in location five. Following on from the string splicing module (covered in the previous article) the program comes to the module in figure 5. Going through this module, N is given the value one to begin with, so X$(TO 3) is equal to 'TAK' and V$(I, TO 3) is equal to 'GO'. These two are not equal and so N is increased to 2. V$(2, TO 3) is equal to 'TAK'. As these two are equal the program then reaches 'THEN GOSUB V(N)'. V(2) is line number 2000, and so the computer is directed to line 2000, where the 'TAKE' routine is located.

The first line of this subroutine sets up the variable FL, used as an indicator flag. In the example, the location L, is five, N is one, O(N), therefore, is also five, Y$(TO 3) is 'KNI' and O$(I, TO 3) is 'KNI', and because these are equal the flag, FL, is set to one and variable O(N) is set to minus one in the next line. If O(N) is set at minus one, and not, as is usual, a location number, the computer then recognises that the player is carrying this object. As FL now equals one, the computer prints the message 'OK — IT'S YOURS' and returns to the module in figure 5. This module moves the computer to line 100 to reprint the location description (without the taken object) and to enable the player to continue the game. The PAUSE command in figure six is to allow the player to read the message.

Using the same example, with the input altered to 'DROP KNIFE', I can explain the drop routine. The computer is directed to line 3000 where the drop routine is located by the module in figure five, as previously explained.

Figure seven shows the 'DROP' routine, which also begins by setting the flag, FL, to zero. The program goes around the loop until it finds a value of O(N) which equals minus one, which indicates that the object is being held by the player. The computer then checks if Y$(TO 2), which is 'KN', is equal to O$(N, TO 2), also 'KN', to be sure that it is the same object, as players can obviously carry more than one object. As this comparison is true, the flag, FL, is set to one and O(N) is set to the present location number, L. The object will stay at the location where it is dropped, unless moved again by the player. As FL = I, the message 'OK — YOU DROPPED IT' is displayed to the player. The computer then returns to the main 'brain' program and continues the game.

Inventory

Another necessary routine dealing with objects is the inventory which prints a list of all the objects carried by the player. Figure eight shows the inventory listing, which begins at line 4000. Once more the flag, FL, is set to zero and the message 'YOU ARE CARRYING :—' is printed. The following lines print out the full list of the player's objects. If the variable O(N) has the value minus one and not the value of a location number, then this indicates that the player is carrying object number N. The flag is set to one and O$(N), the object's name is printed on the screen. In this way a list of objects carried by the player at any time is printed on the screen. If O(N) is never equal to minus one for all the objects then the player is carrying nothing and the flag stays set at zero. If, after completing the loop, FL is still equal to zero then the message 'NOTHING' is printed, indicating exactly what the player is carrying. The computer then returns from the subroutine to the main 'brain' program once more.

Figure nine is a diagram showing the structure of the program so far and where the various listings fit in. In the next article in this series I shall deal with specific subroutines needed for this particular example adventure, incorporating techniques you can use in your adventures, and round up any loose ends.

Figure 1: ZX81 verb initialising

```
8200 DIM O$(5,10)
8220 DIM O(5)
8229 REM PUT OBJECTS INTO O$
8230 LET O$(1)="KNIFE"
8239 REM ASSIGN OBJECT LOCATION
```

▶

```
824Ø LET O(1)=5
825Ø LET O$(2)="PISTOL"
826Ø LET O(2)=2
8269 REM ..AND SO ON..
```

Figure 2: Spectrum version

```
82ØØ DATA  "Knife",5,"Pistol",2:
REM etc. etc....
```

Figure 3: ZX81 SET UP

```
3Ø GOTO 8ØØØ
```

Figure 3B: Spectrum data module

```
3Ø RESTORE 82ØØ: FOR I=1 TO 8
4Ø READ O$(I),O(I)
5Ø NEXT I
6Ø FOR I=1 TO (number of verbs)
7Ø READ V$(I),V(I)
8Ø NEXT I
```

Figure 4:Object printing routine

```
27Ø PRINT
28Ø PRINT "YOU CAN SEE "
29Ø LET FL=Ø
299 REM 8=NO OF OBJECTS
3ØØ FOR N=1 TO 8
31Ø IF L=O(N) THEN PRINT O$(N)
32Ø IF L=O(N) THEN LET FL=1
33Ø NEXT N
34Ø IF FL=Ø THEN PRINT "NOTHING
USEFUL"
```

Figure 5: Verb routine

```
8ØØ FOR N=1 TO (number of verbs
81Ø IF X$( TO 3)=V$(N, TO 3) TH
EN GOSUB V(N)
82Ø NEXT N
83Ø PRINT "I CANT ";X$
84Ø GO TO 1ØØ
```

Figure 6: Take routine

```
2ØØØ LET FL=Ø
2ØØ5 REM 7=NO OF OBJECTS
2Ø1Ø FOR N=1 TO 7
2Ø2Ø IF L=O(N) AND Y$( TO 3)=O$(
N, TO 3) THEN LET FL=1
2Ø3Ø IF L=O(N) AND Y$( TO 3)=O$(
N, TO 3) THEN LET O(N)=-1
2Ø4Ø NEXT N
2Ø5Ø IF FL=Ø THEN PRINT "IT IS N
OT HERE"
2Ø6Ø IF FL=1 THEN PRINT "OK - IT
 IS YOURS"
2Ø7Ø PAUSE 5ØØ
2Ø8Ø RETURN
```

Figure 7: Drop routine

```
3ØØØ LET FL=Ø
3Ø1Ø FOR N=1 TO 7
3Ø15 REM 7=NO OF OBJECTS
3Ø2Ø IF O(N)=-1 AND Y$( TO 3)=O$
(N, TO 3) THEN LET FL=1
3Ø3Ø OF O(N)=-1 AND Y$( TO 3)=O$
(N, TO 3) THEN LET O(N)=L
3Ø4Ø NEXT N
3Ø5Ø IF FL=Ø THEN PRINT "YOU DON
T HAVE IT"
3Ø6Ø IF FL=1 THEN PRINT "OK. YOU
DROPPED IT"
3Ø7Ø PAUSE 5ØØ
3Ø8Ø RETURN
```

Figure 8: Inventory routine

```
4ØØØ LET FL=Ø
4Ø1Ø PRINT "YOU ARE CARRYING:-"
4Ø2Ø FOR N=1 TO 7
4Ø3Ø IF O(N)=-1 THEN LET FL=1
4Ø4Ø IF O(N)=-1 THEN PRINT O$(N)
4Ø5Ø NEXT N
4Ø6Ø IF FL=Ø THEN PRINT "NOTHING
"
4Ø7Ø PAUSE 5ØØ
4Ø8Ø RETURN
```

FIGURE NINE : PROGRAM STRUCTURE

- INITIALISATION (2) FIGURE 3
- LOCATION DESCRIPTION (1) FIGURE 3 (2) FIGURE 4
- STRING SLICING (1) FIGURE 6
- SUBROUTINE LOCATION (2) FIGURE 5
- MOVEMENT SUBROUTINE (1) FIGURE 7
- TAKE SUBROUTINE (2) FIGURE 6
- DROP SUBROUTINE (2) FIGURE 7
- INVENTORY SUBROUTINE (2) FIGURE 8
- SPECIFIC SUBROUTINES ARTICLE 3
- LOCATION DESCRIPTIONS (1) FIGURE 1 (1) FIGURE 2
- DIRECTION DATA (1) FIGURE 4
- OBJECT DATA (2) FIGURE 1 (2) FIGURE 2 ARTICLE 3

Light Screen Designer

Part Six

Toni Baker continues our machine code mega-program

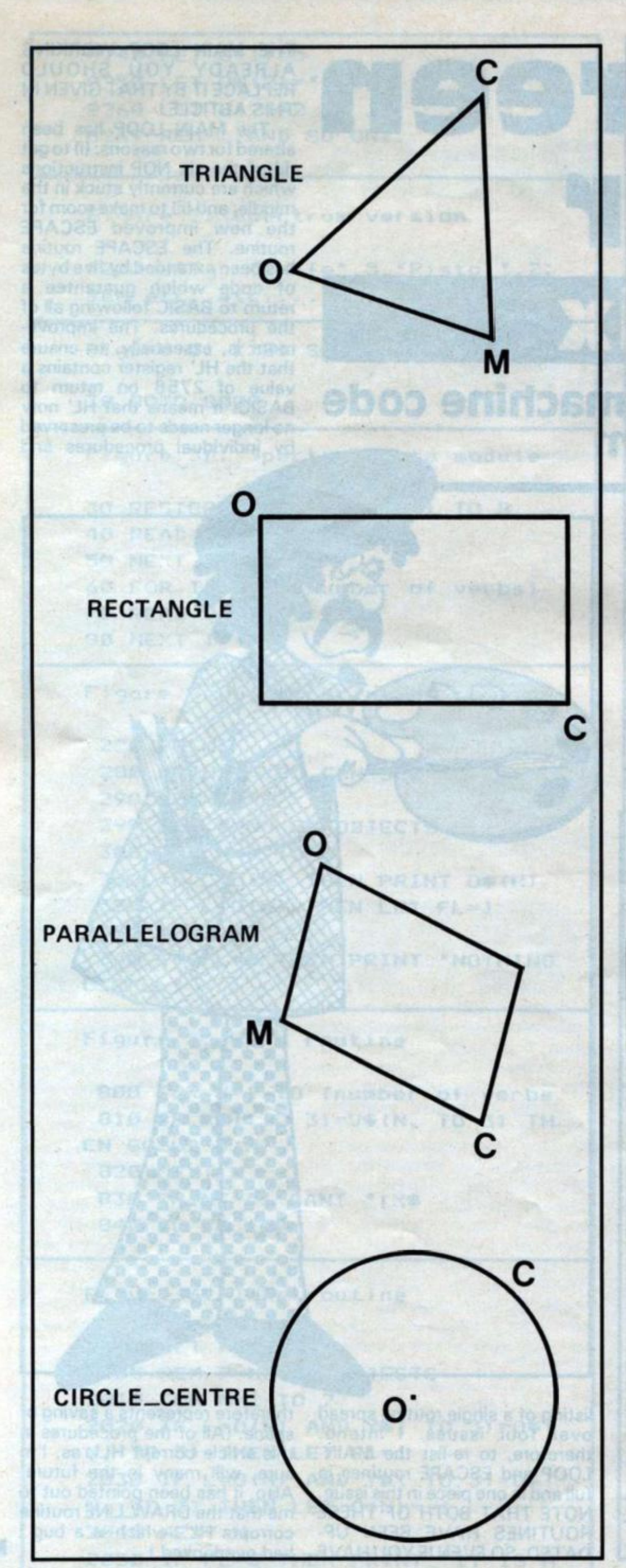
This part of the program concentrates on some of the simpler geometry functions. In particular, I intend to activate four more of the keys. In order of complexity; TRIANGLE (key K), RECTANGLE (key J), PARALLELOGRAM (key U), and CIRCLE_CENTRE (key H). In addition I intend to modify the main loop and ESCAPE routine (key SPACE) so that a full return to BASIC is possible in all circumstances and without error.

The MAIN LOOP for this program was first listed in Light Screen Designer Part 3. The addition of new code in part 4 (a copy screen subroutine) meant that the main loop could be improved by altering part of the code, however the new code was in error and the correction for it appeared in part 5. It stands to reason, therefore, that if I make further alterations in part six then things will get very, very confusing indeed, with the listing of a single routine spread over four issues. I intend, therefore, to re-list the MAIN-LOOP and ESCAPE routines in full and in one piece in this issue. NOTE THAT BOTH OF THESE ROUTINES HAVE BEEN UPDATED, SO EVEN IF YOU HAVE THE MAIN LOOP WORKING ALREADY YOU SHOULD REPLACE IT BY THAT GIVEN IN THIS ARTICLE.

The MAIN LOOP has been altered for two reasons: (i) to get rid of the six NOP instructions which are currently stuck in the middle, and (ii) to make room for the new improved ESCAPE routine. The ESCAPE routine has been extended by five bytes of code which guarantee a return to BASIC following all of the procedures. The improvement is, essentially, to ensure that the HL' register contains a value of 2758 on return to BASIC. It means that HL' now no longer needs to be preserved by individual procedures and therefore represents a saving of space. (All of the procedures in this article corrupt HL', as, I'm sure, will many in the future. Also, it has been pointed out to me that the DRAW_LINE routine corrupts HL', which is a bug I had overlooked.)

```
                        ORG DE1B
CDB6DD    MAIN_LOOP     CALL DDB6,DR_CURSORS      Draw all required cursors.
CDB5DC                  CALL DCB5,GET_CHR         Wait for key press.
CDB6DD    MAIN_LOOP_2   CALL DDB6,DR_CURSORS      "Undraw" the cursors.
2A14DB                  LD HL,(CURSOR)
ED4B16DB                LD BC,(CURSOR+2)
D5                      PUSH DE                   Stack the key scan.
7B                      LD A,E                    A:= key code.
FE03                    CP 03
284D                    JR Z,CSR_DOWN             Jump if "cursor down" pressed.
FE04                    CP 04
283A                    JR Z,CSR_LEFT             Jump if "cursor left" pressed.
FE0B                    CP 0B
2840                    JR Z,CSR_UP               Jump if "cursor up" pressed.
FE13                    CP 13
2837                    JR Z,CSR_RIGHT            Jump if "cursor right" pressed.
21ADDE    ML_TEST       LD HL,DEAD,NULL TABLE
011100                  LD BC,0011
EDB1                    CPIR                      Is key pressed in null table?
280A                    JR Z,ML_ACTION            Jump if so.
2141DB                  LD HL,J_FLAGS high
CB66                    BIT 4,(HL)
CCC9DE                  CALL Z,DEC9,COPY_SCREEN   Copy screen if allowed.
CBAE                    RES 5,(HL)
D1        ML_ACTION     POP DE                    DE:= keyboard scan.
211BDE                  LD HL,DE1B,MAIN_LOOP
E5                      PUSH HL                   Force subroutine return address
                                                  to be MAIN_LOOP.
2142DB                  LD HL,DB42,CMD_ADDRS
14                      INC D
2803                    JR Z,ML_CASE              Jump unless "Shift" pressed.
E1                      POP HL                    Drop MAIN_LOOP address.
1839                    JR RET_BASIC              Prepare to return to BASIC.
7B        ML_CASE       LD A,E                    A:= key code.
87                      ADD A,A
85                      ADD A,L
6F                      LD L,A                    HL: points to subroutine address.
```






```
4E                      LD C,(HL)
23                      INC HL
46                      LD B,(HL)               BC:= subroutine address.
C5                      PUSH BC
2A14DB                  LD HL,(CURSOR)
ED4B16DB                LD BC,(CURSOR+2)
C9                      RET                     Jump to required subroutine.
CD13DD    CSR_LEFT      CALL DD13,LEFT_PIX      Move cursor left.
180D                    JR CSR_STORE
CD1FDD    CSR_RIGHT     CALL DD1F,RIGHT_PIX     Move cursor right.
1808                    JR CSR_STORE
CD29DD    CSR_UP        CALL DD29,UP_PIX        Move cursor up.
1803                    JR CSR_STORE
CD36DD    CSR_DOWN      CALL DD36,DOWN_PIX      Move cursor down.
3807      CSR_STORE     JR C,CSR_EXIT           Jump if cursor cannot move.
2214DB                  LD (CURSOR),HL
ED4316DB                LD (CURSOR+2),BC
D1        CSR_EXIT      POP DE                  DE:= keyboard scan.
14                      INC D
288D                    JR Z,MAIN_LOOP          Loop back unless "Shift" pressed.
CDB6DD                  CALL DDB6,DR_CURSORS    Re-draw the cursors.
76                      HALT
76                      HALT                    Wait for 1/25th of a second.
CDC0DC                  CALL DCC0,GET_CHR_2     DE:= keyboard scan.
1889                    JR MAIN_LOOP_2          Loop back.
```

```
                        ORG DE98
CD9EDE    RET_BASIC     CALL DE9E,ESCAPE
C31BDE                  JP DE1B,MAIN_LOOP
CDCCDC    ESCAPE        CALL DCCC,MESSAGE
12                      DEFB 12                 Print message and await reply.
FE59                    CP "Y"
C0                      RET NZ                  Return unless reply was "Y".
D9                      EXX
E1                      POP HL                  Drop return address to empty
                                                the stack.
215827                  LD HL,2758
D9                      EXX                     HL':=2758 to ensure return to BASIC.
C9                      RET                     Return to BASIC
00        ESC_BYTE      DEFB 00                 Byte unused as yet.
```

```
                        ORG E01C
CD41DD    DRAW_TO_BC    CALL DD41,PIX_ADDR      HL:= pixel address.
C304DF                  JP DF04,DRAW_LINE       Jump to draw line.
E1        TEST_MARKER   POP HL                  HL:= address of next instruction.
3A13DB                  LD A,(MARKER+3)
FEB0                    CP B0
D0                      RET NC                  Return if marker unused.
E9                      JP (HL)                 Otherwise continue from
                                                next instruction.
CD22E0    TRIANGLE      CALL E022,TEST_MARKER   Return if marker not in use.
ED5B0EDB                LD DE,(ORIGIN+2)        DE:= origin cursor coords.
C5                      PUSH BC                 Stack Main cursor coords.
D5                      PUSH DE
C5                      PUSH BC
ED4B12DB                LD BC,(MARKER+2)        BC:= marker coords.
1845                    JR PAR_3                Jump to draw three lines.
C5        RECTANGLE     PUSH BC                 Stack main cursor coords.
ED5B0EDB                LD DE,(ORIGIN+2)        DE:= origin coords.
D5                      PUSH DE
C5                      PUSH BC
42                      LD B,D
CD1CE0                  CALL E01C,DRAW_TO_BC    Draw first line.
C1                      POP BC
C5                      PUSH BC
CD1CE0                  CALL E01C,DRAW_TO_BC    Draw second line.
C1                      POP BC
D1                      POP DE
D5                      PUSH DE
4B                      LD C,E
1836                    JR PAR_2                Jump to draw remaining two lines.
```

```
                          ORG E050
CD22E0    PARALLELOGRM    CALL E022,TEST_MARKER    Return if marker not in use.
ED5B12DB                  LD DE,(MARKER+2)         DE:= marker coords.
2A0EDB                    LD HL,(ORIGIN+2)         HL:= origin coords.
79                        LD A,C
93                        SUB E
3804                      JR C,PAR_NEG1
85                        ADD A,L                  A:= x coord of 4th vertex.
D8                        RET C                    Return if off screen
1802                      JR PAR_X4
85        PAR_NEG1        ADD A,L                  A:= x coordinate of 4th vertex.
D0                        RET NC                   Return if off screen.
08        PAR_X4          EX AF,AF'                Store in A'.
78                        LD A,B
92                        SUB D
3807                      JR C,PAR_NEG2
84                        ADD A,H                  A:= y coordinate of 4th vertex.
D8                        RET C                    Return if out of range.
FEB0                      CP B0
D0                        RET NC                   Return if off screen.
1802                      JR PAR_Y4
84        PAR_NEG2        ADD A,H                  A:= y coord of 4th vertex.
D0                        RET NC                   Return if off screen.
C5        PAR_Y4          PUSH BC
E5                        PUSH HL
67                        LD H,A
08                        EX AF,AF'
6F                        LD L,A                   HL:= coords of 4th vertex.
E5                        PUSH HL
C5                        PUSH BC
42                        LD B,D
4B                        LD C,E
CD1CE0                    CALL E01C,DRAW_TO_BC     Draw first line.
C1                        POP BC
CD1CE0    PAR_3           CALL E01C,DRAW_TO_BC     Draw next line.
CD38DF                    CALL DF38,CANCEL_MARK    Cancel marker cursor.
C1                        POP BC
CD1CE0    PAR_2           CALL E01C,DRAW_TO_BC     Draw next line.
C1                        POP BC
CD1CE0                    CALL E01C,DRAW_TO_BC     Draw next line.
183D                      JR CC_MOVE
```

```
                          ORG E08F
C5        CIRCLE_CENT     PUSH BC                  Stack cursor coords.
ED5B0EDB                  LD DE,(ORIGIN+2)         DE:= origin coords.
CDE6DE                    CALL DEE6,ADJUST_BD      Adjust to ROM convention.
C5                        PUSH BC
D5                        PUSH DE
21925C                    LD HL,MEMBOT
22655C                    LD (STKEND),HL           Point calculator stack into
                                                   calculator memories.
7A                        LD A,D
CD282D                    CALL 2D28,STACK_A        Stack origin-y on calc stack.
D1                        POP DE
7B                        LD A,E
CD282D                    CALL 2D28,STACK_A        Stack origin-x on calc stack.
C1                        POP BC
C5                        PUSH BC
78                        LD A,B
CD282D                    CALL 2D28,STACK_A        Stack cursor-y on calc stack.
C1                        POP BC
79                        LD A,C
CD282D                    CALL 2D28,STACK_A        Stack cursor-x oh calc stack.
2A635C                    LD HL,(STKBOT)
22655C                    LD (STKEND),HL           Restore (empty) calc stack.
EF        CC_DRAW         RST 28                   Engage the calculator.
E1                        recall M1                Ox
E0                        recall M0                Ox,Oy
31                        duplicate                Ox,Oy,Oy
E2                        recall M2                Ox,Oy,Oy,Cy
03                        subtract                 Ox,Oy,Oy-Cy
31                        duplicate                Ox,Oy,Oy-Cy,Oy-Cy
04                        multiply                 Ox,Oy,(Oy-Cy)^2
E1                        recall M1                Ox,Oy,(Oy-Cy)^2,Ox
E3                        recall M3                Ox,Oy,(Oy-Cy)^2,Ox,Cx
03                        subtract                 Ox,Oy,(Oy-Cy)^2,Ox-Cx
31                        duplicate                Ox,Oy,(Oy-Cy)^2,Ox-Cx,Ox-Cx
04                        multiply                 Ox,Oy,(Oy-Cy)^2,(Ox-Cx)^2
0F                        add                      Ox,Oy,(Oy-Cy)^2+(Ox-Cx)^2
28                        sqr                      Ox,Oy,radius
38                        end calc
```

Geometry Procedures

Four of the Designer's geometry procedures are given in this article. The best way to illustrate their operation is by diagram — therefore I have included four such diagrams. Two of them — TRIANGLE and PARALLELOGRAM require the use of three cursors at once. The third cursor is called the MARKER cursor, and may be activated by the MARK key (key S) or deactivated by the CANCEL MARK key (key D). RECTANGLE draws a rectangle whose sides are always horizontal and vertical — therefore it is only necessary to specify two opposite corners. This is done with the ORIGIN cursor (the position of the last point plotted, or the position set by MOVE (key A)), and the CURSOR itself. PARALLELOGRAM draws a four sided shape in which all opposite sides are parallel. It works out for itself the position of the fourth vertex.

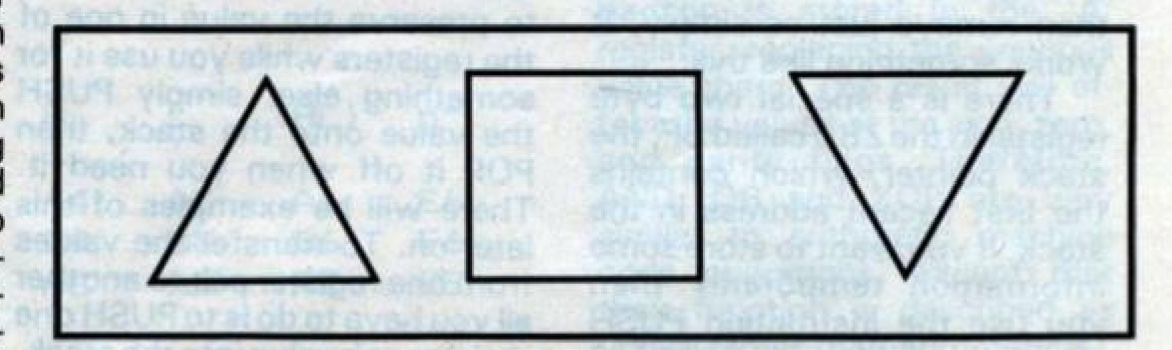
While using LSD it is possible for the user to produce some errors. Most of these are catered for by the program — for instance — if you try to draw a triangle or a parallelogram whilst the marker cursor is inactive, or if you try to draw a parallelogram whose fourth vertex would need to be off the screen. In both of these cases no error message will be supplied, however the shape will not be drawn. There is, however, one error which LSD cannot cope with: that is if you try to draw a circle which will not fit on the screen. If this error should occur you can recover from it by the following procedure: type the command CONTINUE to get back into Light Screen Designer (or RANDOMIZE USR 56789 if originally operated as a direct command). Press ESCAPE (SPACE) once to commence the program, and then press UNDO (key zero).

In the next article I shall continue with, and hopefully complete, the remaining geometry functions. With these available, Light Screen Designer will begin to get some of the feel of its full potential.

```
CD2D23                    CALL 232D,CIRCLE_1       Draw the circle.
C1        CC_MOVE         POP BC                   BC:= cursor coordinates.
CD41DD                    CALL DD41,PIX_ADDR       HL:= cursor address.
C3F3DE                    JP DEF3,MOVE             Move origin to cursor position.
```

The following changes must be made to the command addresses table:

DB44: 8F E0	DEFW E08F, CIRCLE-CENTRE
DB54: 3A E0	DEFW E03A, RECTANGLE
DB56: 53 E0	DEFW E053, PARALLELOGRAM
DB64: 2A E0	DEFW E02A, TRIANGLE
DB82: 9E DE	DEFW DE9E, ESCAPE



First steps in Machine Code



Part 3. Bits and Stacks

An introduction to Z80 Machine Code by David Nowotnik

Ever wondered how a computer remembers where to turn to after completing a subroutine? All will be revealed in this, the fourth part of my machine code series. And, we will see lots of ways in which the smallest unit of memory, the bit, can be utilised to produce interesting machine code routines. But first, the stack!

The stack

So far, we've dealt with many instructions to transfer bytes from one place to another — mainly from one register to another, and between memory and the registers. There is a special store of bytes of informaton in RAM called 'the stack'. which has its own set of machine code instructions. The curious thing about the stack is that you usually don't have to worry about where in RAM it is stored; the processor does this for you automatically. You can change the position of the stack if you want to (with special machine code instructions), but it is usual to leave it where the processor puts it after power-up, which is just below RAMTOP.

What is 'the stack'? It's a 'pile' of bytes starting, as I said, just below RAMTOP, and building in a downward direction in RAM. The purpose of the stack is to have a temporary store of information (bytes) which you can dump there with a simple one byte instruction, then remove just as simply. It works something like this:

There is a special two byte register in the Z80 called SP, the stack pointer, which contains the first vacant address in the stack. If you want to store some information temporarily then you use the instruction PUSH to place that information (bytes) onto the stack. You can only PUSH onto the stack the value in a pair of registers; for example, PUSH HL, PUSH DE, PUSH BC, and PUSH AF (the 'A' register and the flag register combined) are the only PUSH instructions permitted. When you PUSH values onto the stack, the SP register is decremented by two, so that it contains the new address of the next free position in the stack. The stack is built up by moving DOWN in memory.



To remove a value from the stack, the instruction POP is used, and the value 'POPed' from the stack can be placed in one of the register pairs. As part of the POP instruction, the SP register is twice incremented, to show once more the address of the next free place on the stack. All the opcodes for the PUSH and POP instructions are shown in table 1. All are one byte instructions.

The stack is designed to make life easier for programmers. For example, if you want to preserve the value in one of the registers while you use it for something else, simply PUSH the value onto the stack, then POP it off when you need it. There will be examples of this later on. To transfer the values from one register pair to another all you have to do is to PUSH one register pair value into the stack, then POP it into the other register pair. I demonstrated this in the last issue, although I didn't explain how it worked. The machine code routine in the demonstration of flags program (Fig.1 in part 3) had as consecutive instructions PUSH AF, POP DE. This placed the values A and F onto the stack, then placed them in D and E, respectively. This ėnabled the F register to be copied into the E register, from where it can be more closely examined.

You have to be quite careful how you use the stack. It operates by a last-on, first-off principle, so you must get the order on and off just right. The stack is also used by the Z80 processor outside of your control. Here's the answer to the subroutine question!

When you call a subroutine, either in BASIC, or a machine code subroutine, the return address is dumped onto the stack. If you call several subroutines, the return addresses are placed onto the stack in the correct order, and you'll always return to the right place in the program after each RETURN instruction because of the last on, first off principle of the stack. It is important therefore, to make sure that the number of POP instructions within a subroutine balances the number of PUSH instructions (and not to POP a value off the stack before one is PUSHed there), otherwise you could end up removing a return address, and causing yourself some real headaches.

Working with Bits

There are far more machine code instructions that deal with bits than there are ones which manipulate bytes. So, it won't be of surprise to you that I won't be covering all of them this time, and I'll be saving some for the next part of this series. However, having said that, there is a very large number of instructions which can all be grouped into a relatively small number of categories. But before we start to examine some of these, it might be useful to re-examine what a bit just happens to be.

Every byte of memory or register in the Z80 processor is made up of 8 bits. Each bit is, effectively, an electrical switch; it has two states, on or off, which can be represented by the values 1 or 0. There are 256 possible combinations of ones and zeros in the eight bits that make up a byte, hence the value range that a byte can hold is 0 to 255. In fig.1 there is a BASIC program for both ZX81 and Spectrum which demonstrates how the values of bits are combined to make up the value of a byte. When you RUN the program, the first thing you have to do is enter a decimal value. The binary representation of that value (ie the way it is held as ones and zeros in a byte) is shown on the screen. These bits are numbered 0 to 7 from right to left. Then watch the screen while you get a display of how to calculate the decimal value of a byte. Every time there is a '1' in a bit, then the value of that bit is added to the total. See if you can work out the relationship between a bit value and its number (0 to 7). If you want to slow down the display, then increase the size of the loop in line 1000.

With the knowledge that each bit has the effective value

Table 1. Opcodes for PUSH and POP instructions

Registers:	HL	DE	BC	AF
PUSH	E5	D5	C5	F5
POP	E1	D1	C1	F1

Table 2. Opcodes for the SET/RESET/BIT instructions

SET

Bit:		0	1	2	3	4	5	6	7
Register:	A	C7	CF	D7	DF	E7	EF	F7	FF
	B	C0	C8	D0	D8	E0	E8	F0	F8
	C	C1	C9	D1	D9	E1	E9	F1	F9
	D	C2	CA	D2	DA	E2	EA	F2	FA
	E	C3	CB	D3	DB	E3	EB	F3	FB
	H	C4	CC	D4	DC	E4	EC	F4	FC
	L	C5	CD	D5	DD	E5	ED	F5	FD
	(HL)	C6	CE	D6	DE	E6	EE	F6	FE

RESET

Bit:		0	1	2	3	4	5	6	7
Register:	A	87	8F	97	9F	A7	AF	B7	BF
	B	80	88	90	98	A0	A8	B0	B8
	C	81	89	91	99	A1	A9	B1	B9
	D	82	8A	92	9A	A2	AA	B2	BA
	E	83	8B	93	9B	A3	AB	B3	BB
	H	84	8C	94	9C	A4	AC	B4	BC
	L	85	8D	95	9D	A5	AD	B5	BD
	(HL)	86	8E	96	9E	A6	AE	B6	BE

BIT

Bit:		0	1	2	3	4	5	6	7
Register:	A	47	4F	57	5F	67	6F	77	7F
	B	40	48	50	58	60	68	70	78
	C	41	49	51	59	61	69	71	79
	D	42	4A	52	5A	62	6A	72	7A
	E	43	4B	53	5B	63	6B	73	7B
	H	44	4C	54	5C	64	6C	74	7C
	L	45	4D	55	5D	65	6D	75	7D
	(HL)	46	4E	56	5E	66	6E	76	7E

NOTE: All BIT/SET/RESET opcodes are preceded by CB

Table 3. AND/OR/XOR Opcodes

Register/byte:	A	B	C	D	E	H	L	(HL)	n*
AND:	A7	A0	A1	A2	A3	A4	A5	A6	E6
OR:	B7	B0	B1	B2	B3	B4	B5	B6	F6
XOR:	AF	A8	A9	AA	AB	AC	AD	AE	EE

* – n refers to an operand appearing immediately after the opcode for AND, OR, or XOR in the machine code routine.

of one or zero, it may not come as a surprise to learn that the simplest of machine code bit operations involves setting the value of a specified bit to 1, or 0, or testing whether a bit's value is either 1 or 0. You can SET (bit = 1) or RESET (bit = 0) values, or test them with the BIT instruction, for any bit in the main registers, A,B,C,D,E,H,L, or a bit in a byte of memory addressed by HL. If you work out all the combinations, then there are 64 SET instructions, 64 for RESET, and 64 for BIT. All are shown in Table 2. The SET, RESET and BIT instructions are all two bytes long, and all have as the first byte of the instruction, the hex value CB.

All the assembly language instructions for BIT, SET, and RESET require two arguments to complete the instruction; the first is the identifying number of the bit (0 to 7), and the second is the register, or byte (with (HL)) identifier. For example, SET 5,E places the value 1 in bit 5 of the E register, and RESET 1,L places the value 0 in bit 1 of the L register.

The BIT instruction tests the value of the specified bit, and places the result in the zero flag. If the bit value is 1, then 1 is placed in the Z flag. The Z flag can then be tested, as described in the last issue. For example, BIT 3,(HL) tests the value of bit 3 in a byte of memory identified by the value in HL.

Another group of machine code instructions which work on bits have the opcodes AND, OR, and XOR. The first two will be familiar to BASIC programmers; the machine code and BASIC instructions of AND and OR are related, although that may be difficult to understand while I explain how they work!

AND, OR, and XOR carry out bit-by-bit comparisons of two bytes. One byte must be in the 'A' register, the other byte must exist in any register (including 'A'), or a byte of memory addressed by HL, or a byte of data stored immediately after the operand in the machine code routine. The result of this comparison is stored in the 'A' register, replacing the previous value there. The result will effect the values of the sign, zero, and parity flags. Therefore, AND, OR and XOR are very similar to arithmetic machine code operations, except that their function is described as 'logic' rather than arithmetical.

Fig.2 shows a number of what are called 'truth' tables. These show the result of comparing two bits by one of the ▶

'logic' operations, AND, OR, or XOR. For example, if you AND a bit value 1 with a bit of value 0, then the result is 0. OR the same two values, and the result will be 1; XORing 1 and 0 also give you 1. In fact, OR and XOR are very similar, except that 1 OR 1 = 1, whereas 1 XOR 1 = 0.

How these 'truth' tables work in practice is also shown in Fig.2. Work your way through the three logic 'sums' comparing each pair of bits with the corresponding truth table. Then try the three 'sums' which do not have an answer. The answer does appear at the end of this article, together with the decimal equivalent of the binary answer. You should be able to work out for yourself the decimal value — if you've practised using the program in Fig.1. You may well be asking by now "what is the use of these 'logical operators'?" There will be some examples of them later on, but, in summary:

AND is used mainly for masking 'bits' within a byte. Say you wanted to reset bits 0 to 3 (i.e. make them all 0). You could use the RESET command four times, but it is far easier to use the machine code command AND 11110000. As bits 0 to 3 in the operand are all zero, then (from the truth tables) the bits 0 to 3 in the result must also be zero.

OR — In a similar manner to AND, the instruction OR will set a block of bits so that they all have the value '1'. For example, OR 00001111 ensures that bits 0 to 3 will all be 1 in the result.

XOR allows comparisons of bits such that, if they are the same, then the result is 0, and if they are different, the resultant bit value is 1. When you PRINT OVER 1 on the Spectrum, you are, in fact using the XOR instruction. Think of a pixel in the INK colour as '1' and a pixel in the PAPER colour as '0' (which they are), and try a few PRINT OVER 1s to see the effect. AND, OR, and XOR opcodes appear in table 3.

In the style of previous parts of this series, we'll now move onto some machine specific examples; ZX81 first, followed by examples for the Spectrum. You should see several of the items of theory covered in this, and previous parts, hopefully helping you to clarify the theory. The ZX81 examples contain more on PUSH and POP, whereas the ones for the Spectrum have more on the logical operators, so it's advised that you read through both sets of examples.

Fig.1. Binary Demonstration Program

```
10 REM BINARY DEMONSTRATION
20 REM  BY DAVID NOWOTNIK
30 REM  MARCH, 1985
40 REM
100 CLS
110 PRINT AT 21,0;"ENTER A VALUE (0-255) "
120 INPUT A
130 IF A<0 OR A>255 THEN GOTO 120
140 LET A= INT A
150 LET B$=""
160 LET Z=A
170 IF Z=0 THEN GOTO 250
180 LET X=Z/2
190 IF X=INT X THEN LET B$="0"+B$
200 IF X<>INT X THEN LET B$="1"+B$
210 LET Z=INT X
220 GOTO 170
250 PRINT AT 4,2;"NUMBER= ";A
260 LET B$="00000000"+B$
270 LET L= LEN B$
280 LET B$=B$(L-7 TO )
300 PRINT AT 8,2;"BINARY= ";B$
400 PRINT AT 21,0;"NOW CONVERT BINARY TO DECIMAL"
410 LET S=0
420 PRINT AT 20,12;"TOTAL= ";S
500 FOR I=0 TO 7
520 GOSUB 1000
530 PRINT AT 7,17-I;"V "
540 PRINT AT 10,2;"BIT VALUE = ";2^I
550 GOSUB 1000
560 LET T= VAL B$(8-I)*2^I
570 PRINT AT 12,5;B$(8-I);" X ";2^I;" = "T
580 LET S=S+T
590 GOSUB 1000
600 PRINT AT 12,28;S
610 GOSUB 1000
620 NEXT I
630 PRINT AT 21,0;"  PRESS ANY KEY TO CONTINUE   "
640 IF INKEY$="" THEN GOTO 640
650 RUN
700 REM
1000 FOR J=1 TO 200
1010 NEXT J
1020 RETURN
```

Fig.2. Truth Tables, and examples of AND, OR, and XOR

a) Truth Tables

AND Truth Table:

```
|        Bit 1: | 0 | 1 |     0 AND 0 = 0
| Bit 2:      0 | 0 | 0 |     0 AND 1 = 0
|             1 | 0 | 1 |     1 AND 1 = 1
```

OR Truth Table

```
|        Bit 1: | 0 | 1 |     0 OR 0 = 0
| Bit 2:      0 | 0 | 1 |     0 OR 1 = 1
|             1 | 1 | 1 |     1 OR 1 = 1
```

XOR Truth Table

```
|        Bit 1: | 0 | 1 |     0 XOR 0 = 0
| Bit 2:      0 | 0 | 1 |     0 XOR 1 = 1
|             1 | 1 | 0 |     1 XOR 1 = 0
```

```
b) Example Logical Operations
        AND                     OR                      XOR
.   00110101 = 43        01001000 = 72          11100000 = 224
    10100100 = 174       00101001 = 41          01010001 = 81
.   00100100 = 36        01101001 = 105         10110001 = 177

c) Examples to try for yourself
        AND                     OR                      XOR
.   01010101             10100110               11001010
.   00110011             11001100               01101100
Answers at the end of this article
```

Fig.3. ZX81 Machine code examples

```
10 REM ........................................
20 LET X=16514
40 FOR I=1 TO LEN A$/2
50 LET J=16*( CODE A$-28)+ CODE A$(2)-28
60 IF PEEK X=27 THEN POKE X,J
70 LET X=X+1
80 LET A$=A$(3 TO )
90 NEXT I
100 CLS
110 FOR I=1 TO 10
120 PRINT "1234567890ABCDEFGHI"
130 PRINT "ABCDEFGHIJKLMNOPQRS"
140 NEXT I
150 IF INKEY$="" THEN GOTO 150
160 RAND USR 16514
170 GOTO 150
```

First machine code routine:

```
30 LET A$="113C402A0C40012100C5D5C5E5EDB0E154
5DC10901F702EDB0E1C1EDB0C9"
```

Assembly language listing

```
        LD DE,16444     113C40    DE=printer buffer address
        LD HL,(16396)   2A0C40    HL=Display file start
        LD BC,33        012100    Length of character row
        PUSH BC         C5        Store for future use
        PUSH DE         D5
        PUSH BC         C5
        PUSH HL         E5
        LDIR            EDB0      Store row in printer
                                    buffer
        POP HL          E1
        LD D,H          54        DE has first screen
        LD E,L          5D          address
        POP BC          C1        Put 33 back into BC
        ADD HL,BC       09        HL=HL+BC
        LD BC,759       01F702    Chars. for block move.
        LDIR            EDB0      Block move for SCROLL
        POP HL          E1        Printer buffer address
        POP BC          C1        BC=33.
        LDIR            EDB0      Replace bottom line
        RET             C9        Return to BASIC
```

b) Second Machine code routine

```
30 LET A$="2A0C400618C50620237EF6807710
F923C110F2C9
```

Assembly Language Listing

```
        LD HL,(16396)   2A0C40    Load HL with D-File
        LD B,24         0618      B= number of rows
LOOP1   PUSH BC         C5        Save row counter
        LD BC,32        0620      Number of characters/row
LOOP2   INC HL          23        Get next character
        LD A,(HL)       7E        Load with screen character
***     OR 128          F680      Convert to white on black
```

ZX81 Examples

Before we begin with the ZX81 examples; a word of warning about the stack on the '81. As I mentioned earlier, the stack appears just below RAMTOP, i.e. RAMTOP as set up by the computer on power-up. If you lower RAMTOP, for example, to make space for a machine code routine, then you could be encroaching into the stack area. POKEing anything into the stack area by mistake is a certain recipe for disaster. The safest way to create space for machine code at the top of RAM is to use NEW after lowering RAMTOP. This will relocate the stack below the new RAMTOP, but, of course, wipe out any BASIC program, such as a machine code loader.

To avoid any danger of corrupting the stack, the examples in this issue use another method of saving machine code on the ZX81; in a REM line. The method was introduced in the last part, but wasn't fully explained at that time. The position of a BASIC program is fixed in the ZX81's memory, starting at address 16509. If the first line is a REM statement, then it (like all other REM lines) is ignored by the BASIC interpreter, so you can put anything you like into it, including machine code bytes. And that is what the hex loader in fig.3 carries out. The first byte after the REM token in line 10 will always be address 16514 (as long as no other line precedes 10), so you can replace the 'dummy' full stops in the REM line by machine code bytes. Line 60 checks that you are overwriting a full stop, and not another character, then the machine code byte is POKEd in. Once in the REM line the machine code can be stored with the rest of the BASIC program. But beware; if you LIST the program, then you might corrupt the display file with 'unprintable' machine code values. Better to LIST 20, so that line 10 does not appear on the screen. First of all, enter the main listing in Fig.3, then add whichever line 30 is appropriate for the routine you want to try.

The two machine code examples in Fig.3 produce effects on the display file, so you'll see straight away if they are working correctly. The first causes the screen to 'rotate'; i.e. it is like a normal SCROLL except that the line which disappears off the edge of the screen reappears on the other side. The rotate routine works on all 24 ▶

rows of the screen, so press any key a few times to appreciate the effect. The second routine converts the entire screen to a white on black display — instantly!

As before, use a 16K (or larger) RAM pack with these examples, otherwise they may not work.

Spectrum Examples

The two Spectrum examples use the same decimal loader as used in Part 3. The CLEAR instruction lowers RAMTOP and moves the stack to below the new RAMTOP, so giving you an area of RAM which is quite safe to use. Type out the loader, then add the DATA lines appropriate to the routine you want to try.

The first routine scans the display file, and inverts every bit (i.e. changes 1 to 0, and 0 to 1), so reversing INK and PAPER. The important instruction for this is XOR 255. The second routine scans the attribute file and 'toggles' the flash bit (that is, turns FLASH on if it finds the bit off, and vice versa). So, from a non-flashing screen, you should get the entire screen flashing. Try it!

Both Spectrum examples display one way of overcoming a major error in the Z80. Surprisingly, when using DEC on a two byte register, it doesn't reset the zero flag when the double register holds a value of zero. So, when using, say, BC as a counter, JR NZ after DEC BC will not work when BC becomes zero. It's a common mistake amongst beginners to machine code to assume (naturally) that it does. The way to overcome this is shown in the examples. Having carried out the DEC BC, the values in B and C are (effectively) ORed (after the value in B is transferred to the A register). Only when both B and C contain zero will the result of the OR operation be zero. The zero flag is reset when the result of a logical operation is zero, so the flag can be tested after the OR operation.

The final items for this part are the results of the tests. These are as follows: AND: 00010001 (17); OR: 11101110 (238); XOR: 10100110 (166). If you don't agree with these results, then try again, working through the program in Fig.1 and the examples in Fig.2.

```
        LD (HL),A        77       Place in display file
        DJNZ, LOOP2      10F9     Repeat to row end
        INC HL           23       Jump over NEWLINE
        POP BC           C1       Recover the row counter
        DJNZ, LOOP1      10F2     Do again, until all done.
        RET              C9       Return to BASIC
```

*** This routine will always give you a white on black display. You can change it quite simply to interconvert black on white and white on black by changing the line marked with three asterisks to:

```
        ADD 128          C680
```

Fig.4. Spectrum Machine Code Examples

```
10 CLEAR 24999
20 LET i=25000
30 READ x: IF x=-1 THEN GO TO 200
40 POKE i,x: LET i=i+1
50 GO TO 30
190 DATA -1
200 CLS
210 FOR i=1 TO 10
220 PRINT "abcdefghijklmnopqrstuvwxyz"
230 PRINT "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
240 NEXT i
250 RANDOMIZE USR 25000
260 IF INKEY$=""****N GO TO 260
270 GOT TO 250
```

First Machine Code Example

```
100 DATA 33,0,64,1,0,24,126
110 DATA 238,255,119,35,11,120
120 DATA 177,32,246,201
```

Assembly Language Listing

```
        LD HL,16384      210040   HL=Display File start
        LD BC,6144       010018   Bytes in display file/x
LOOP    LD A,(HL)        7E       Transfer bytes to A
        XOR 255          EEFF     Invert bits
        LD (HL),A        77       Put byte back
        INC HL           23       Next byte
        DEC BC           0B       Decrement counter
        LD A,B           78       Test if 0
        OR C             B1
        JR NZ, LOOP      20F6     If not, repeat
        RET              C9       Else return to BASIC
```

Second Machine Code Example

```
100 DATA 33,0,88,1,0,3,126,198,128
110 DATA 119,35,11,120,177,32,246,201
```

Assembly Language Listing

```
        LD HL,22528      210058   Start of Attributes
        LD BC,768        010003   Number of attribute bytes
LOOP    LD A,(HL)        7E       Load A with attribute
        ADD 128          C680     Toggle on/off FLASH
        LD (HL),A        77       Return the byte
        INC HL           23       Next byte
        DEC BC           0B       Decrement counter
        LD A,B           78       Test if 0
        OR C             B1
        JRNZ, LOOP       20F6     If not, repeat
        RET              C9       else return to BASIC
```

Across The Pond

Mark Fendrick looks at the U.S. market place

It is interesting to note how the North American Sinclair (Timex) market has developed along entirely different lines from that of its counterparts in the rest of the world. Today, in England, you can walk into practically any shop that handles computers and find Sinclair computers, software and peripherals. Chain operations such as John Menzies, and W. H. Smith carry a vast assortment of goodies to interest the Sinclair computerist. No ZX owner ever has to explain his pride in his micro.

In North America, however, the Sinclair community has developed into somewhat of an underground society. Walk into any computer establishment and announce that you are looking for Timex/Sinclair compatibles, and you are either laughed at, or find yourself trying to explain how powerful these little micros are. For a while, while Timex was in the business of selling Sinclair computers, a few select stores did have an over the counter trade in T/S 1000's a few software titles, (I never spotted a store which stocked the software that Timex licensed from me, for example), and possibly a T/S2040 printer (now available as the Alphacom 32). But more likely than not, the line was more of an afterthought than an actively displayed product.

When Timex stopped producing computers, and got out of the business, even this half-hearted effort at marketing stopped cold! The T/S 1000's which were left were selling for as little as $29.00! Software could be had for as little as three or four dollars in some discount stores. Soon, you could not find any Timex/Sinclair related product in any store. Many people were already writing the Timex/Sinclair obituary. The Sinclair dedicated publications folded, and the general computer magazines were no longer interested in reporting on our computers. In fact, only one national publication is sold on the newsstands which carries a Timex Sinclair Survival Column.

No hope then for us Timex/Sinclair owners? Quite the contrary, things have been developed faster than before Timex pulled the plug. Although many of the third party suppliers were initially uncertain of the future, it soon became obvious that the new Timex/Sinclair computers (T/S 1500 and T/S 2068) would be in demand until supplies were exhausted, and that those new owners would want to use their micros to the fullest. A few tentative attempts from the people who were supporting the Timex/Sinclair line for the previous two years proved successful, and things were underway.



New Products

Two products developed for Timex were ready for the market, and were soon released by third parties. the modem, to be produced by Anchor Automation for Timex, was released by Anchor after licensing both telecommunications software packages from Micro-Systems. The other package which Timex commissioned Micro-Systems to produce was a word processing program which would take advantage of many of the T/S 2068's advanced features (such as 64 column display), and print to a full size printer. The result was MSCRIPT, a program comparable to any available for the TRS-80 or IBM-PC. (MSCRIPT has become my wordprocessor.) Without Timex, though, there was no distributor... that is until Twenty-first Century Electronics (6813 Polk Street, Guttenburg, NJ 07093; (201) 869-2616) licensed it for distribution.

Soon it was business as usual for most of the Timex/Sinclair developers and suppliers. But unlike in the rest of the world, the products did not find their way into the stores, and reverted to an almost entirely mail order culture. Even in the few shops where there is an over the counter Timex/Sinclair business, it represents a small part of the business which relies on mail order business.

One such company, whose business is Sinclair computers, is Zebra Systems, Inc., (78-06 Jamaica Avenue, Woodhaven, NY 11421; (718) 296-2385), and they are still very actively developing and producing add-ons for our micros. Their most recent development is a graphics interface which permits the use of a Koala Digitizing tablet. This combination allows you to "draw" on the tablet with the enclosed stylus, and see the picture appear on the screen.

The package comes with the graphics interface, (which attaches to the rear expansion bus of the T/S 2068 and has a through connector which permits additional peripherals to be added), the Koala Pad, stylus, Zpaint software, and an instruction booklet. The Koala pad is connected directly to the interface (there are two sockets, presumably for future developments), you LOAD the software, and you are ready to go.

You have two development screens on which to work, one active and one inactive, and may switch back and forth between them at will. along the bottom of the screen is your control menu, from which you can set various parameters for use in creating your graphics. By moving the cursor to a spot on this menu, and pressing the command button on the pad, you may select the colour of the screen border, paper and ink. To draw, you place the stylus on the pad, press the draw button and draw on the tablet. As you draw, the tablet translates the pressure into a digital signal which the computer can understand and transfer to the display file. You may draw in one of two modes; either a thin stroke (pen) or a wide stroke (brush). The width is selected from the command menu. If you make a mistake, or want to change some part of your graphic just change the DRAW toggle to ERASE, and instead of placing something on the screen, you will erase anything in the path of the cursor as you move it across the screen.

There are other choices available to you as you proceed along the command menu. If you want to draw perfectly straight lines, proceed to the VERTICAL/HORIZONTAL toggle, and select either direction. (Normal drawing is in the V&H mode.) In either VERTICAL or HORIZONTAL mode, only movement in the desired direction will be recognized. Any motion in the other plane will be ignored. If you want to create a straight line between any two points, go to the LINE selection and press the command button. Then by moving the cursor to each of the desired end points, the computer will supply the line on the screen. Want to draw a circle but freehand circles never look right? The CIRCLE option allows you to define the position of the centre of the circle, and the location of the circumference, and the circle is drawn automatically. You also have the ability to insert text into your graphic from the keyboard. The final option allows you to type in other commands which include switching the active and *inactive screens, SAVEing the* current active screen, LOADing a screen to the active file, or COPYing to your T/S 2040 (or Alphacom 32) printer. (Note: the original ZX printer, only a few of which found their way to the U.S., does not work on the T/S 2068.) Also from here you can clear the screen to start creating a new graphic.

Finally, as promised, I have been seeking out sources of software for the American T/S owner. Now that SPECTRUM EMULATORS, ROMSWITCHES, and SPECTRUM ROMS are readily available and popular in the U.S., mail order houses in the U.K. can supply a variety of titles. A very reliable company is SOFTWARE SUPERMARKET (87 Howard's Lane, London SW15 6NU, England). They promise, and deliver, a very fast turn around time, and I have always received my order from them in less than ten days after I mailed my order to them. (Always use airmail when sending trans-atlantic mail, otherwise you will find it takes well over a month to arrive — one way!) They accept VISA and MASTERCARD which makes the exchange of currency extremely easy.

Keep those cards and letters coming and I will see you right here next time. ■

Warts and all (or a novice's guide to machine code)

E Hutchinson is a brave man, here he reveals his darkest secrets from the depths of Inverness...

Scroll left

Whilst working on a project I had need of a Scroll Left routine and the following is an account of how it was developed, including all the mistakes. I am a novice at the game, being self-taught, and I found that, in the main, books gave me techniques and end results, but with little indication of how they were developed. So, here now is my novice's guide to Machine Code, Warts and all!

First, I found the display file where the picture is stored. Address 16396 contains the bottom half of the address, and address 16397 the top half (see ch.27 of ZX81 manual, for details of the system variables). So . . .

PRINT PEEK 16396 + 256 * PEEK 16397

Table 1

Op Code 42	LD HL, NN N 12 * 1 + N 64 * 256	Loads the L Register with Contents of Location = 16396 And then loads the H Register with the contents of Location 16397. This is the start of the D File, and contains 118. The first displayed Character is at location (HL) + 1. Therefore
Start Op Code 35	Inc HL	Increase HL by 1 HL now contains the Address of the first Displayed Character. We do not want this one . . . so
Op Code 35	Inc HL	Again. Now we have the Address of the 2nd Character in the top line.
Op Code 126	LD, A, (HL)	Put the Code for this Character into the Accumulator
Op Code 43	DEC HL	Then go back to the Address of First Character
Op Code 119	LD (HL), A	Put 2nd Chracter into 1st Address Jump back to start.

and . . . Bingo! The display starts here at 16509 Try it . . .

Now to put something into it, take the code for the letter A (which is 38) and Poke it into 16509. POKE 16509,38. And there we are, the system crashes. Why?

It turns out that the Display File Address is the last one before the display and NOT the first one on the screen. This is the Display File Address + 1. So,

POKE (16509 + 1),38.

An A appears at the top left hand corner. To save writing we'll call this position X. So,

X = (Peek 16396 + 256 * Peek 16397) + 1

This is the first column on the top line. There are 32 columns, so the last column is X + 31, and the next Address is at the end of the line which contains a New Line Chr. Code 118. The next Address is the first column on the second line, so it looks like this:

Address	Contents
16509	118 New Line
16510	Chr. Code 1st Column Top Line Column 0
+31	= 32 Characters
16541	Chr. Code Last column Top Line Column 31
16542	118 New Line
16543	Chr. Code 1st Column 2nd Line

And so on (refer to Sinclair Manual Page 123.)

In order to Scroll Left we have to take the Code in Address X + 1 and move it back to Address X, then move on, take X + 2 and move it to X + 1 and so on. There are several ways to do this. For instance, line by line as I have, or column by column using another Loop. In Basic we could do this by PEEKing into each Address in turn, checking to see if it is the end of a line, checking if we have done every line and then POKE it into the previous address. This would take a while, so we do exactly the same thing using Machine Code instead. I used the HL Registers, B Register and Accumulator. And the sequence went like this:

The Registers in the Z80 M.P.U. are simply temporary storage locations. I visualise them as pigeon holes holding an 8 Bit Binary Number (see Table 1).

This would, unfortunately, keep Scrolling the first line until the end of line marker 118 at Address No.1 + 32 was overwritten and the system would crash. So, we keep this routine, but insert some means of checking when we have reached the line end.

Now, we can do this by putting the Newline Code into the Accumulator and comparing the contents of the Accumulator with the contents of the Address held in HL. The number we want to compare is 118, but unfortunately if we enter this into our REM where we are saving this Routine, the computer will think this is the end of the line, and do all sorts of funny things. Therefore, we put in 119 and DEC. or substract 1. Now, we also want someone to keep count of how many lines we have done and when we get to 22 to return to the Basic Program. So, table 2 looks like this:

Table 2

Op Code 42	LD HL, 12, 64 N1 12 Nh 64	 Lower Value Higher Value
Op Code 6	LD B,N N22	Load B with This number This is how many lines we have to do
Op Code 35	INC HL	
Op Code 35	INC HL	
Op Code 62	LD A,N N 119	Load Accumulator with This number
Op Code 61	DEC A	Subtract 1 = 118
Op Code 190	CP (HL)	Compare with the number at Address (HL)

Now, if these numbers are the same, in this case, 118, then the Z flag is set. In other words, the answer is 0. I found this rather confusing at first, because if the answer is 0 the Z flag is set to "1", but in fact the

flag is asking 'Is the answer zero'?, and the flag then indicates 'YES' flag set or 'NO' flag reset. Rather a case of yes we have no bananas!

If a match is found then we are at the end of the line, so we do not overwrite the end marker. Instead, we subtract 1 from our number of lines.

Dec B

And jump back to INC HL twice. We can do this in several ways. We can find the Address of the first INC HL and just use JP N1 Nh where the Address is (Nh ✱ 256) + (N1 ✱ 1). The trouble with this is that if you move the routine to a different part of the memory it all has to be re-calculated.

However, we have a lovely instruction just made to order. It is called DJNZ e, which means Decrement B and if the result is not zero then jump backwards or forwards a number of addresses, indicated by 'e'. If e is greater than 130 then we jump backwards (256-e) places. If e is less than 130 then we jump forward e places (I suppose that if e = 130 we jump up and down on the spot, though I haven't tried it!). For reasons I don't yet understand you have to subtract 2 from e before you use it. If a match is not found then we carry on. (Table 3.)

This means jump forwards or backwards, but without any conditions attached. In our case, jump back to the start. Now there is only one other thing. . . If B is zero after we Decrement it, then the job is done and we want to return to the Basic Program. All we have to do then is, after comparing A and (HL), if a match is found we DEC B, and if B does not equal 0, jump to start. If B is zero, we return to the Basic Program. So, now our Program looks like this (Table 4).

Now, before we develop it further, try this one. I found it fascinating. Use the Loader Program to enter this into a REM statement, then fill the screen with Characters using:

10 FOR N = 0 TO 255
20 PRINTS CHR$N:
30 NEXT N

Then start the SCROLL with;

40 RAND USR 16514

Put in a timing loop;

50 FOR N = 1 TO 20
60 NEXT N
70 GOTO 40

This moves everything to the left except the last column which it repeats all the way across the screen.

For my purposes I needed to blank out the last Column so that I could print or plot other things in it, and then move them across the screen. To print a blank the Code 0 has to be put in. When (HL) contents are 118 we are past the last Column. So, now our program looks like this (Table 5).

Note that we have changed the DJNZ,e to jump to the blanking routine before going to start.

Table 4

Relative Address	Op Code	Operand	Assm. Lang.	Comment
1	42		LD HL N1 Nh	
2		12	N1	Low Value Byte
3		64	Nh	High Value Byte
4	6		LD B,N	Load B with
5		22	N	this number
6 Start	35		INC HL	jumps to here if B ≠ 0
7	35		INC HL	
8	62		LD A,N	Load A with
9		119	N	this number
10	61		DEC A	Subtract 1
11	190		CP (HL)	Compare with Number at Address (HL)
12	32		JRNZ,e	If they are not the
13		3	(e-2)	same jump forward 5 places otherwise
14	16		DJNZ,e	Subtract 1 from B
15		246	(e-2)	and if B = 0 jump to start otherwise
16	201		RET	return to Basic Program
17	126		LD A, (HL)	Jumps to here if (HL) is ≠ 118
18	43		DEC HL	
19	119		LD (HL), A	
20	24		JR,e	
21		240	(e−2)	Jumps back to start.

Machine code loader

```
1    REM
AAAAAAAAAAAAAAAA-
AAAAAAAAAAAAAAA (about
30 or so)
10   FOR N = 16514 to 16544
20   INPUT A
30   PRINT N,A
40   POKE N,A
50   NEXT N
```

Table 3

Op Code	126	LD A (HL)	Take the number out of Address (HL)
Op Code	43	DEC HL	Find the previous Address That is, one place to the left
Op Code	119	LD (HL) A	And put the number into it
Op Code	24	JRe	Then go back to the start and start again

Table 5

Op Code	Operand	Assm. Lang.	Comment
43		DEC HL	This is the last Column
54		LD (HL), N	Put into the last Column
	0	N	Code for a blank
35		INC HL	Put HL back to its end of line value
24	JR,e	Jump back to the start again	
	233	(e-2)	

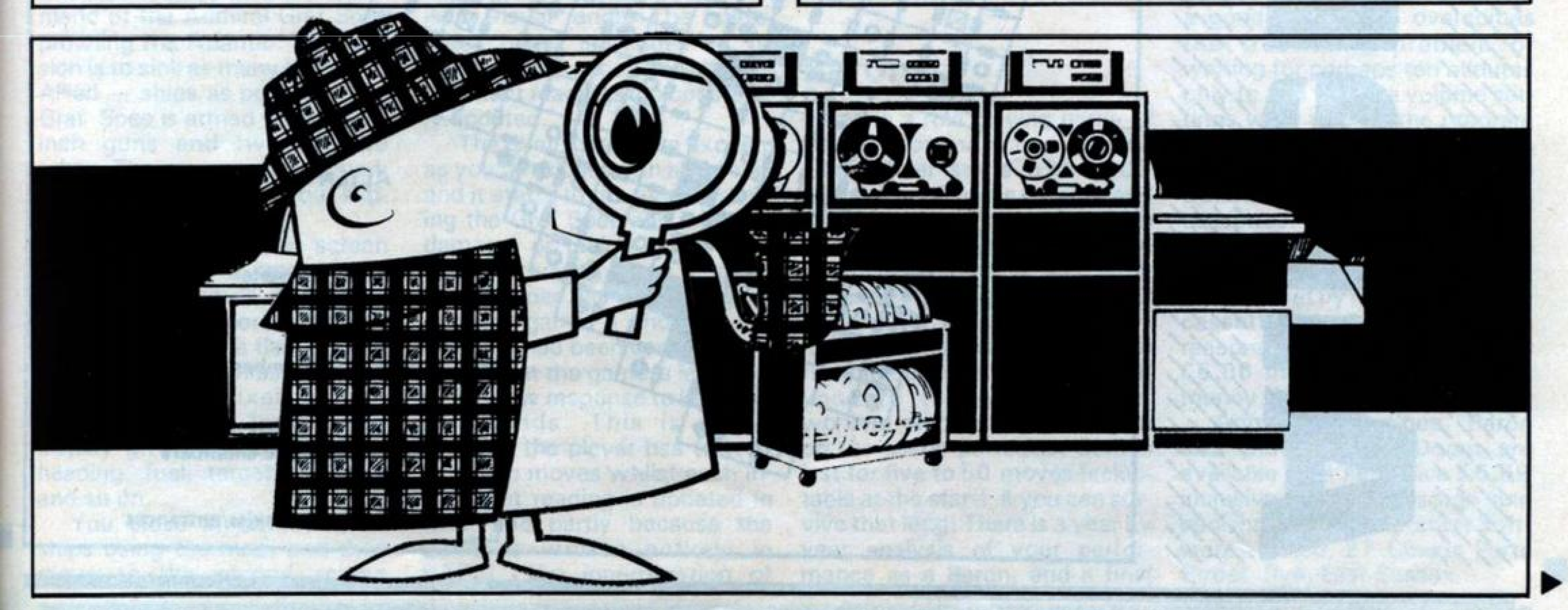


Table 6

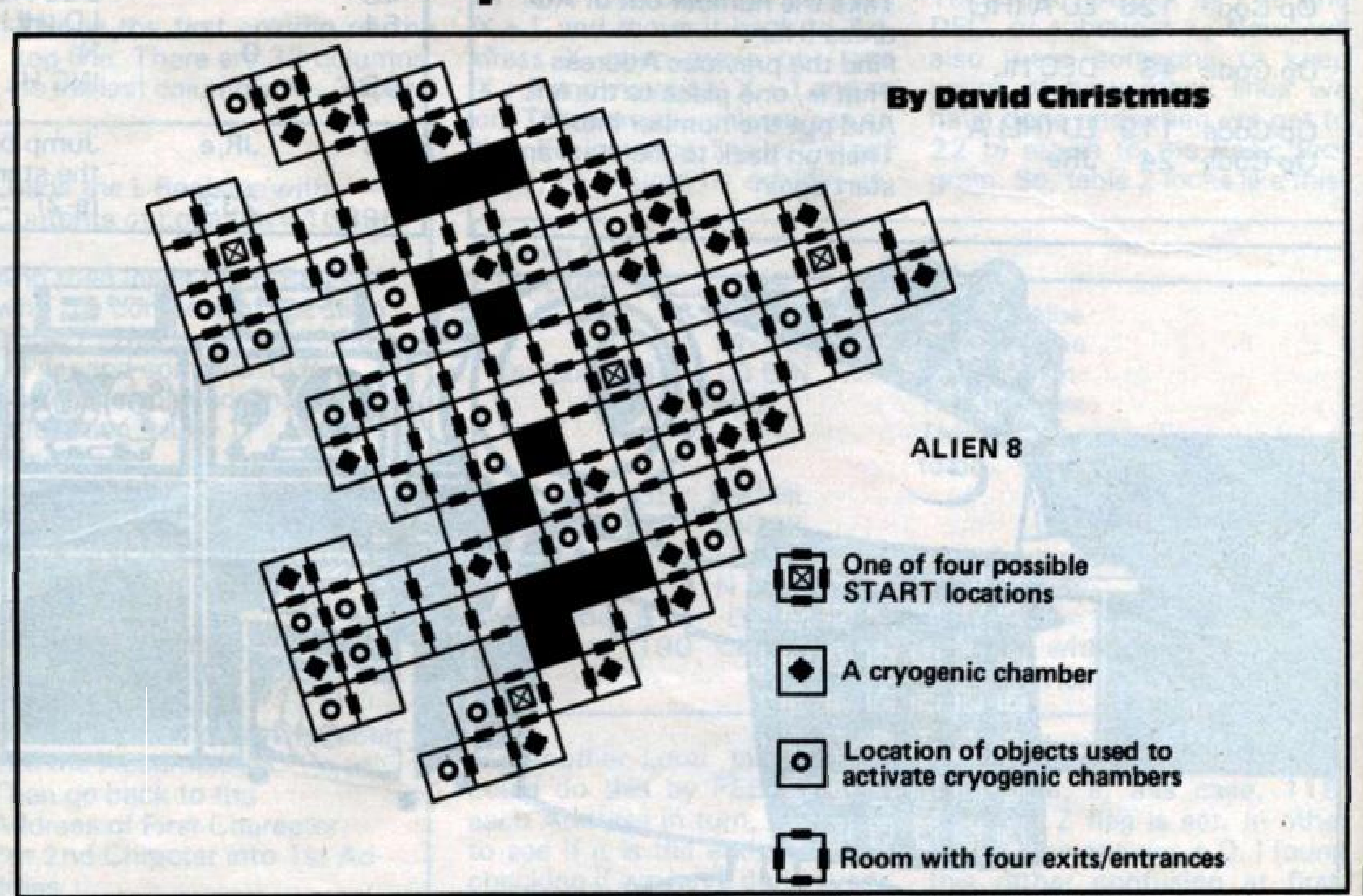
Relative Address	Op Code	Op-erand	Assm. Lang.	Comment
1 start	42		LD HL NN	Address of the start of the D. File
2	12		N1	
3	64		Nh	
4	6		LD B,N	
5	22		N	Number of lines to be Scrolled
6 Loop 1	35		INC HL	Address of 1st Character
7	35		INC HL	Address of 2nd Character
8	62		LD A,N	
9		119	N	119 into the Accumulator
10	61		DEC A	118 in the Accumulator
11	190		CP (HL)	Compare with Contents of HL Address and if
12	32		JRNZ,e	they do not match jump
13		3	(e-2)	3 + 2 places.
14	16		DJNZ,e	If they do, Dec B and, if the
15	6		(e-2)	Result is not 0, jump 6 + 2 places.
16	201		RET	If it is 0 return to Basic
17 Move Chr.	126		LD A,(HL)	Take Character from (HL)
18	43		DEC HL	
19	119		LD (HL),A	Replace it one step back
20	24		JR,e	
21		240	(e-2)	Jump to loop 1
22	43		DEC HL	Jumps to here if (HL) = 118
23	54		LD (HL),N	
24		0	N	Blanks the last Column
25	35		INC HL	Sets HL to the end of Line Address
26	24		JR,e	
27		234	(e-2)	Jumps to loop 1

When you have entered all the Machine Code just enter STOP (shifted A) and NEWLINE. You will have a few 'A's left over, but they don't matter. When the Program is SAVED the REM statement is also saved so that the Routine can be used with any Program.

The Routine has several uses where a continuous graph of a varying quantity is required. Fed by an Analogue-to-Digital Converter it would plot a continuous moving graph of temperature, pressure and light intensity, in fact, any varying quantity which can be represented by a varying voltage. But I hope to go into this later, the project I was working on when I developed the Routine was an Echo Sounder interface to turn the ordinary rotating LED Echo Sounder into a chart recorder.

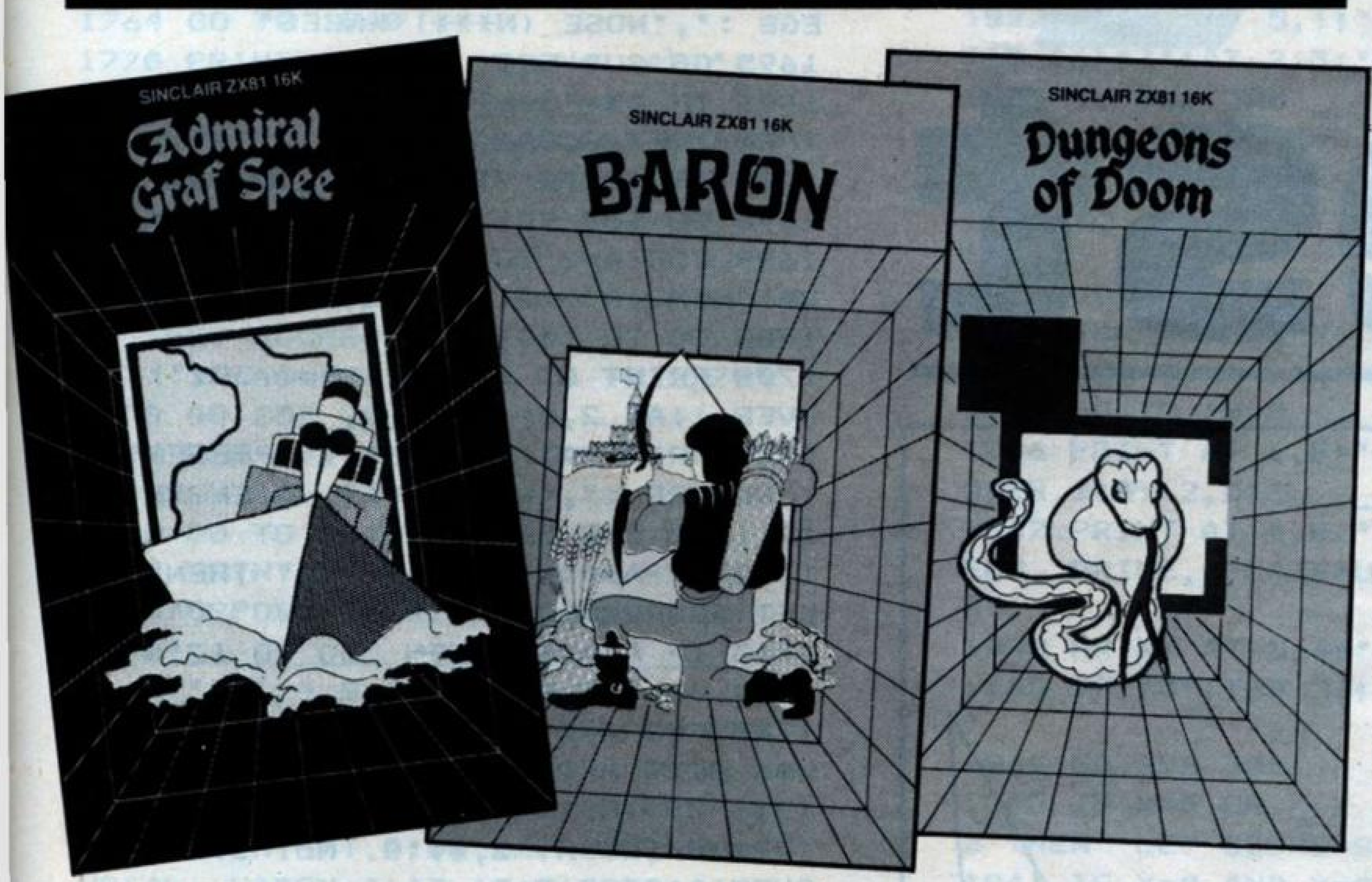


This map was drawn and sent in by super spaceman David Christmas of deepest Dulverton.



ZX81 Soft Selection

Nick Pearce looks at the new 'three pack' from Temptation.



Admiral Graf Spee

It is 1940 and you are in command of the Admiral Graf Spee prowling the Atlantic. The mission is to sink as many enemy — Allied — ships as possible. The Graf Spee is armed with six 11 inch guns and two torpedo tubes. The support ship Altmark is at hand to replenish your supplies and ammunition.

There are two main screen displays. Firstly a map of the South Atlantic is displayed showing the location of the Graf Spee (denoted by a flashing pixel), and the allied ships (intermittent flashing pixels). Also shown is your instrument display giving speed, compass heading, fuel, target distance, and so on.

You close in on the allied ships using the map, and then move to the second screen display which shows the horizon and, when you get very close, the allied ship itself. To destroy the target you must fire whilst it is in visual range. The instrument panel continues to be shown in this second display. Instrument readings are constantly updated.

The game gets quite exciting as you get close to an allied ship and it starts to fire at you, rocking the Graf Spee and inflicting damage; or taking evasive action and moving out of range.

Graf Spee has the makings of a good game. I thought the graphics had been used to good effect, but the game is let down by its slow response to keyed-in commands. This is partly because the player has to wait between moves whilst each instrument reading is updated in turn, and partly because the game is written entirely in BASIC. The incorporation of machine code routines to speed up the programs would result in a faster, more interactive and improved game.

Baron

Baron is a role playing game of strategy for one to four players. Each player starts with 1500 dubloons, 70 acres of land, and 100 workers. The decisions to be made each year include whether to buy or sell land, whether to feed all your workers, or let some starve — merciless dog; whether to hire or fire mercenaries; and so on. If you are too extreme your workers revolt and impale you on the castle portcullis. Games last for five to 50 moves (selectable at the start), if you can survive that long! There is a year by year analysis of your performance as a Baron, and a final score is given. There are frequent disasters to thwart your struggle for success, for example the plague may strike or rats eat your grain.

Baron is a text-only game. It is a reasonable simulation although perhaps somewhat short on interest to hold the attention of the avid role player for long.

Dungeons of Doom

Finally in this set of three cassettes from Temptation Software is Dungeons of Doom, a maze game for up to four players. In this game you have to find your way through some 400 rooms and 600 corridors in an attempt to build up a high score by surviving for as long as possible, and at the same time kill monsters or collect treasure.

The screen displays the room or corridor you are in, and black squares to the North, South, East and West, and above and below. Only on attempting to move into one of these squares is its nature revealed — corridor, room, cave, or stone wall! And any content — monsters or treasure — becomes apparent.

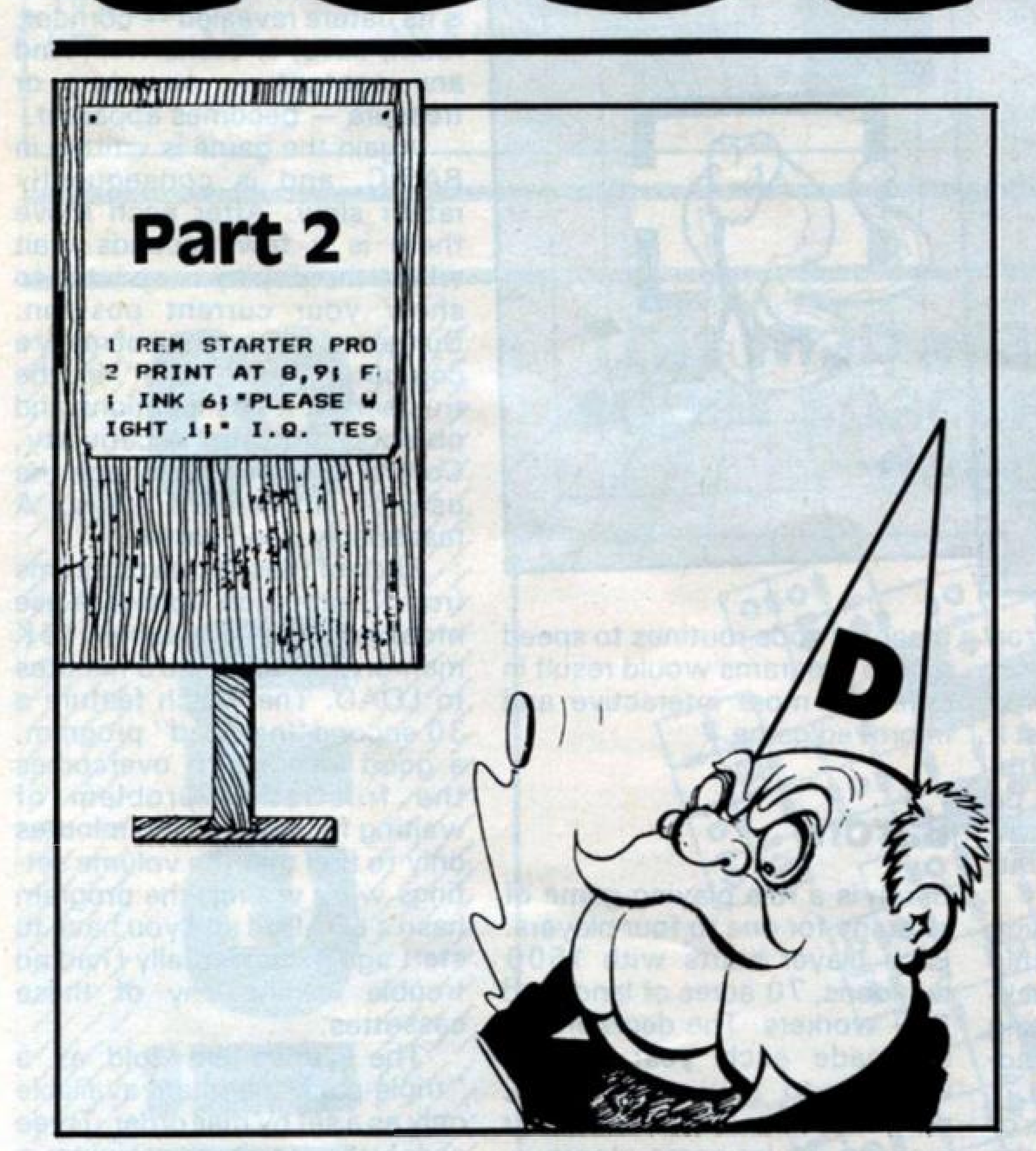
Again the game is written in BASIC, and is consequently rather slow. After each move there is a few seconds wait whilst the display is updated to show your current position. Dungeons of Doom is not really a computer "adventure" in the true sense; it has locations and objects, but no vocabulary. Control is effected through the use of movement keys. A reasonably good game.

Each of these three programs from Temptation Software use most of the available 16K memory and take 7 to 8 minutes to LOAD. They each feature a 30 second "pre-load" program, a good idea which overcomes the frustrating problem of waiting for perhaps ten minutes only to find that the volume settings were wrong, the program hasn't LOADed and you have to start again. Incidentally I had no trouble loading any of these cassettes.

The games are sold as a "triple-pack", and are available only as a set by mail order. Three cassettes each containing a reasonable game for just under £6.00 must be good value for money.

Admiral Graf Spee, Baron and Dungeons of Doom are available as a set, price £5.99 inclusive of VAT postage and packing, from Temptation Software Limited, 27 Cinque Ports Street, Rye, East Sussex. ■





Part two of Greg Turnbull's probing program, full details of which were printed last issue.

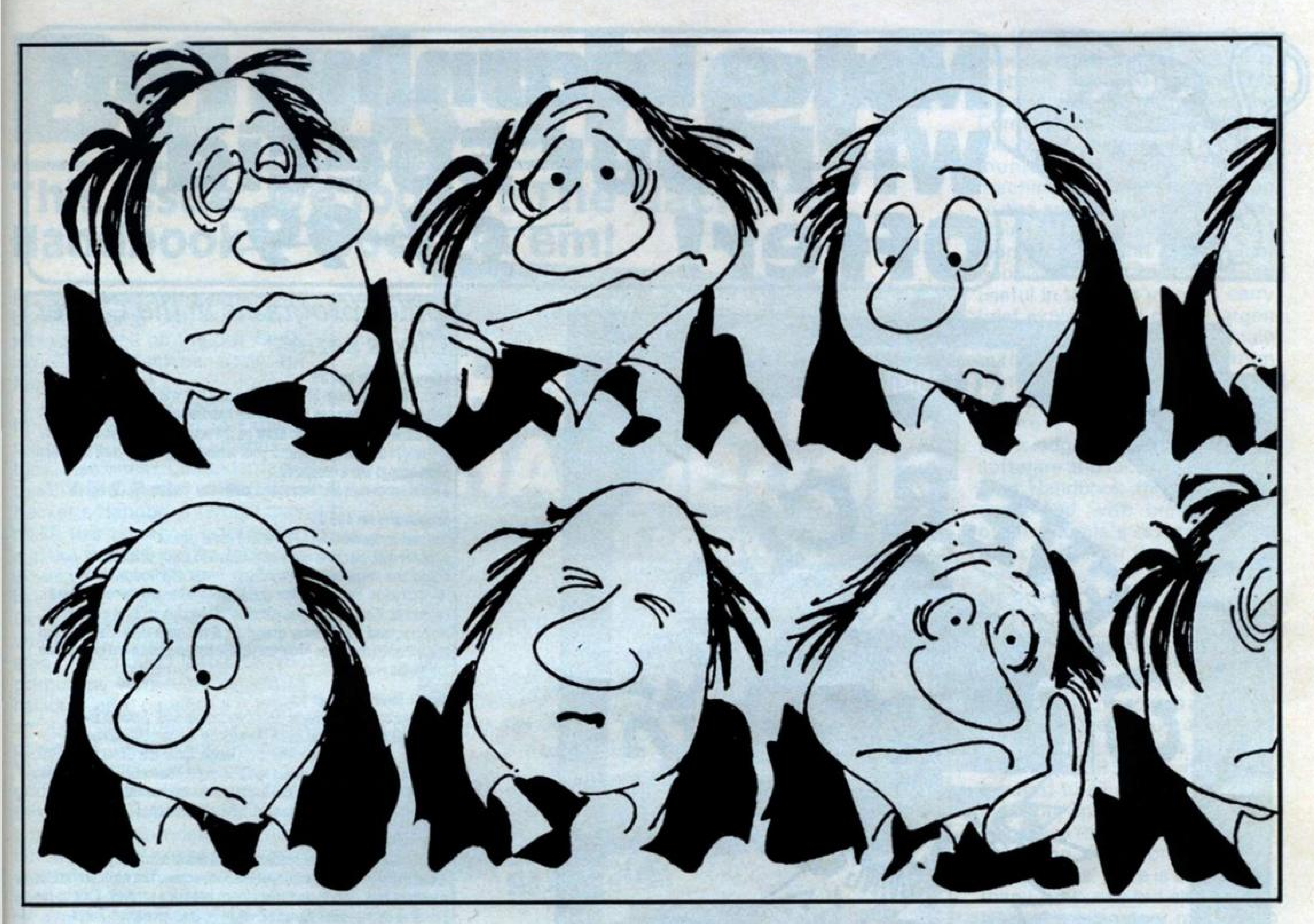
```
1680 IF X=49 THEN  LET SCORE=SCO
RE+1
1681 IF X=0 THEN  GO TO 1683
1682 GO SUB 90
1683 FOR A=2 TO 4: PRINT AT A,0;
W$: NEXT A
1684 GO TO 1040
1692 PRINT AT 2,0;"Q's. 37-42: M
ID-TERMS: Q.37."; OVER 1;AT 2,0;
"______________________   _____";AT
 4,0;"IN EACH Q. THE THREE UPPER
 TERMSCORRESPOND TO THOSE BELOW,
     INSERT THE MISSING LETTERS
."
1693 PRINT AT 8,0;"FACE (BODY) L
EGS :","NOSE (N***) KNEES"
1695 GO SUB 500
1696 IF A$="avel" OR A$="navel"
THEN  LET SCORE=SCORE+1
1697 IF A$="0" THEN  GO TO 1699
1698 GO SUB 90
1699 FOR A=2 TO 9: PRINT AT A,0;
W$: NEXT A
1700 GO TO 1040
1708 PRINT AT 2,0;"Q. No. 38:";
OVER 1;AT 2,0;"_______"
1709 PRINT AT 4,0;"PAST (PRESENT
) FUTURE :","WAS (I***) WILL BE"
1711 GO SUB 500
1712 IF A$="s" OR A$="is" THEN
LET SCORE=SCORE+1
1713 IF A$="0" THEN  GO TO 1715
1714 GO SUB 90
1715 FOR A=2 TO 5: PRINT AT A,0;
W$: NEXT A
1716 GO TO 1040
1724 PRINT AT 2,0;"Q. No. 39:";
OVER 1;AT 2,0;"_______"
1725 PRINT AT 4,0;"COMPLETE (INC
OMPLETE) BLANK :","ALWAYS (S***)
 NEVER"
1727 GO SUB 500
1728 IF A$="ometimes" OR A$="som
etimes" THEN  LET SCORE=SCORE+1
1729 IF A$="0" THEN  GO TO 1731
1730 GO SUB 90
1731 FOR A=2 TO 5: PRINT AT A,0;
W$: NEXT A
1732 GO TO 1040
1740 PRINT AT 2,0;"Q. No. 40:";
OVER 1;AT 2,0;"_______"
1741 PRINT AT 4,0;"GLUT (SCARCIT
Y) FAMINE :","MANY (F***) NONE"
1743 GO SUB 500
1744 IF A$="ew" OR A$="few" THEN
  LET SCORE=SCORE+1
1745 IF A$="0" THEN  GO TO 1747
1746 GO SUB 90
```

```
1747 FOR A=2 TO 5: PRINT AT A,Ø;
W$: NEXT A
1748 GO TO 1Ø4Ø
1756 PRINT AT 2,Ø;"Q. No. 41:";
OVER 1;AT 2,Ø;"__________"
1757 PRINT AT 4,Ø;"RUSHING (PASS
ING) ENDURING :","EVANESCENT (T*
**T) ETERNAL"
1759 GO SUB 5ØØ
176Ø IF A$="ransien" OR A$="tran
sient" THEN  LET SCORE=SCORE+1
1761 IF A$="Ø" THEN  GO TO 1763
1762 GO SUB 9Ø
1763 FOR A=2 TO 5: PRINT AT A,Ø;
W$: NEXT A
1764 GO TO 1Ø4Ø
177Ø PRINT AT 2,Ø;"Q. No. 42:";
OVER 1;AT 2,Ø;"__________"
1773 PRINT AT 4,Ø;"NASCENT (MATU
RE) SENILE :","GREEN (R***) DECA
YED"
1775 GO SUB 5ØØ
1776 IF A$="ipe" OR A$="ripe" TH
EN  LET SCORE=SCORE+1
1777 IF A$="Ø" THEN  GO TO 1779
1778 GO SUB 9Ø
1779 FOR A=2 TO 5: PRINT AT A,Ø;
W$: NEXT A
178Ø GO TO 1Ø4Ø
1788 PRINT AT 2,Ø;"Q's.43-47:SIM
ILAR/OPPOSITE: Q.26"; OVER 1;AT
2,Ø;"______________________
____";AT 4,Ø;"ENTER THE No.s OF
 TWO WORDS WITHEITHER NEARLY EQU
AL MEANINGS OR ALMOST OPPOSITE M
EANINGS."
1789 PRINT AT 8,Ø;"RAPPORT, MERC
URIAL, HAPPY,";AT 1Ø,Ø;"RAPACIOU
S, PHLEGMATIC"
179Ø PRINT AT 9,3;"1";TAB 13;"2"
;TAB 22;"3";AT 11,3;"4";TAB 15;"
5"
1791 GO SUB 3ØØ
1792 IF X=2 OR X=5 AND Y=2 OR Y=
5 THEN  LET SCORE=SCORE+1
1793 IF X=Ø AND Y=Ø THEN  GO TO
1795
1794 GO SUB 9Ø
1795 FOR A=2 TO 11: PRINT AT A,Ø
;W$: NEXT A
1796 GO TO 1Ø4Ø
18Ø4 PRINT AT 2,Ø;"Q. No. 44:";
OVER 1;AT 2,Ø;"__________"
18Ø5 PRINT AT 4,Ø;"TENACIOUS, RE
SOLVE, IRRESOLUTE,";AT 6,Ø;"SOLU
TION, TENACITY"
18Ø6 PRINT AT 5,4;"1";TAB 13;"2"
;TAB 25;"3";AT 7,3;"4";TAB 13;"5
"
18Ø7 GO SUB 3ØØ
18Ø8 IF X=1 OR X=3 AND Y=1 OR Y=
3 THEN  LET SCORE=SCORE+1
18Ø9 IF X=Ø AND Y=Ø THEN  GO TO
1811
181Ø GO SUB 9Ø
1811 FOR A=2 TO 7: PRINT AT A,Ø;
W$: NEXT A
1812 GO TO 1Ø4Ø
182Ø PRINT AT 2,Ø;"Q. No. 45:";
OVER 1;AT 2,Ø;"__________"
1821 PRINT AT 4,Ø;"REAL, RENAL,
LITERALLY,";AT 6,Ø;"SIMILARLY, V
ERITABLY"
1822 PRINT AT 5,1;"1";TAB 8;"2";
TAB 16;"3";AT 7,3;"4";TAB 15;"5"
1823 GO SUB 3ØØ
1824 IF X=5 OR X=3 AND Y=5 OR Y=
3 THEN  LET SCORE=SCORE+1
1825 IF X=Ø AND Y=Ø THEN  GO TO
1827
1826 GO SUB 9Ø
1827 FOR A=2 TO 7: PRINT AT A,Ø;
W$: NEXT A
1828 GO TO 1Ø4Ø
1836 PRINT AT 2,Ø;"Q. No. 46:";
OVER 1;AT 2,Ø;"__________"
1837 PRINT AT 4,Ø;"TOPOGRAPHY, H
EAP, PRIME, PLATEAU";AT 6,Ø;"HOL
E"
1838 PRINT AT 5,4;"1";TAB 13;"2"
;TAB 2Ø;"3";TAB 28;"4";AT 7,1;"5
"
1839 GO SUB 3ØØ
184Ø IF X=5 OR X=2 AND Y=5 OR Y=
2 THEN  LET SCORE=SCORE+1
1841 IF X=Ø AND Y=Ø THEN  GO TO
1843
1842 GO SUB 9Ø
1843 FOR A=2 TO 7: PRINT AT A,Ø;
W$: NEXT A
1844 GO TO 1Ø4Ø
1852 PRINT AT 2,Ø;"Q. No. 47:";
OVER 1;AT 2,Ø;"__________"
1853 PRINT AT 4,Ø;"HATE, AFFECTI
ON, AFFLICTION,";AT 6,Ø;"LOVE, P
ASSION"
1854 PRINT AT 5,1;"1";TAB 1Ø;"2"
;TAB 22;"3";AT 7,1;"4";TAB 9;"5"
1855 GO SUB 3ØØ
1856 IF X=1 OR X=4 AND Y=1 OR Y=
4 THEN  LET SCORE=SCORE+1
1857 IF X=Ø AND Y=Ø THEN  GO TO
1859
1858 GO SUB 9Ø
1859 FOR A=2 TO 7: PRINT AT A,Ø;
W$: NEXT A
```

```
1860 GO TO 1040
1868 PRINT AT 2,0;"Q's.48-50: MA
THS MID-TERMS: Q.26"; OVER 1;AT
2,0;"____________________________
_____";AT 4,0;"IN EACH Q. THE 3
No.s ON THE     LEFT ARE RELATED
TO THOSE ON THERIGHT, ENTER THE
MISSING VALUE."
1869 PRINT AT 8,0;" 7 (12) 5 : 8
 (A) 3"
1871 GO SUB 400
1872 IF X=11 THEN  LET SCORE=SCO
RE+1
1873 IF X=0 THEN  GO TO 1875
1874 GO SUB 90
1875 FOR A=2 TO 8: PRINT AT A,0;
W$: NEXT A
1876 GO TO 1040
1884 PRINT AT 2,0;"Q. No. 49:";
OVER 1;AT 2,0;"__________"
1885 PRINT AT 4,0;" 3 (6) 2 : 3
(A) 3"
1887 GO SUB 400
1888 IF X=9 THEN  LET SCORE=SCOR
E+1
1889 IF X=0 THEN  GO TO 1891
1890 GO SUB 90
1891 FOR A=2 TO 4: PRINT AT A,0;
W$: NEXT A
1892 GO TO 1040
1900 PRINT AT 2,0;"Q. No. 50:";
OVER 1;AT 2,0;"__________"
1901 PRINT AT 4,0;" 49 (15) 64 :
 16 (A) 144"
1903 GO SUB 400
1904 IF X=16 THEN  LET SCORE=SCO
RE+1
1905 IF X=0 THEN  GO TO 1907
1906 GO SUB 90
1907 FOR A=2 TO 4: PRINT AT A,0;
W$: NEXT A
1908 GO TO 1040
1910 REM TIME UP/FINISHED.
1950 PRINT AT 2,0; FLASH 1;"TIME
 UP!"; FLASH 0: PAUSE 75
1955 PRINT AT 2,0;"YOU HAVE FINI
SHED ALL THE Q's.": PAUSE 75
1960 PAPER 6: BORDER 6: INK 0: C
LS
1970 GO SUB 4000: REM IQ RESULT
1990 GO TO 35
2000 REM PERSON. TEST NO.1.
2010 PAPER 6: BORDER 6: INK 0: B
RIGHT 0: CLS : LET PT1A=0
2020 PRINT "PERSONALITY TESTS:";
 OVER 1;AT 0,0;"_________________
_''
2030 LET Y$=" THESE ARE TWO TEST
S WHICH HAVE NO RIGHT OR WRONG A
NSWERS, THEY ARE UNRELATED TO TH
E I.Q. TEST. YOU MUST ANSWER THE
 Q's. WITH A OR B AS QUICKLY AND
 AS HONESTLY AS POSSIBLE, DO NOT
 THINK ABOUT THEM FOR TOO LONG A
S EMOTIONS   ARE IMPORTANT. THE
RESULTS WILL BE GIVEN SOON AFTER
 THE END     OF EACH TEST."
2040 RANDOMIZE USR 65110: FOR Z=
1 TO LEN Y$: IF Y$(Z)=" " THEN
PRINT " ";: GO TO 2060
2050 PRINT Y$(Z);: BEEP .05,25:
PAUSE 2
2060 NEXT Z: RANDOMIZE USR 65120
: PAUSE 25: GO SUB 50: CLS
2065 PRINT "P.TEST NO.1:"; OVER
1;AT 0,0;"____________"''
2070 PRINT "1) WHICH WOULD YOU P
REFER TO BE A SCIENTIST (A) OR A
 POLITICIAN (B)?": GO SUB 600
2080 PRINT "2) DO YOU THINK THAT
 SOME WELL- KNOW, 'HONEST' PROFE
SSIONS DO     MORE HARM (A) THAN G
OOD (B) FOR THIS COUNTRY?": GO S
UB 600
2090 PRINT "3) WHICH IS MORE IMP
ORTANT TO A CRITIC, DISCRIMINATI
ON (B) OR    TOLERANCE (A)?": GO
SUB 600
2100 PRINT "4) WOULD YOU RATHER
BE YOUR OWN BOSS (A), OR A RECEP
TIONIST (B)?": GO SUB 600
2110 PRINT "5) SHOULD A DOCTOR A
LLOW HIMSELFT0 BE EMOTIONAL (B)
IN TREATING PATIENTS, OR NOT (A)
?": GO SUB 600
2120 PRINT "6) DO YOU FIND IT HA
RD (A) TO    MODIFY BEHAVIOUR REL
ATED TO      EVERYDAY RELATIONSHI
PS OR NOT (B)?": GO SUB 600
2130 PRINT "7) ON HOLIDAY DO YOU
 PREFER TO   SPEND TIME READING &
 WALKING (A)OR MEETING PEOPLE (B
)?": GO SUB 600
2140 PRINT "8) WOULD YOU FIND BE
ING A HERMITEASY (A), OR HARD (B
)?": GO SUB 600
2150 PRINT "9) WOULD YOU PREFER
TO MARRY A   THOUGHTFUL (A), OR S
OCIABLE      PERSON (B)?": GO SUB
 600
2160 PRINT "10) ARE MOST PEOPLE
GENERALLY    TRUSTWORTHY (B), OR
NOT (A)?": GO SUB 600
2170 PRINT "11) DO YOU LIKE ORGA
NISING       PARTIES (A), OR NOT
(B)?": GO SUB 600
```

```
2180 PRINT "12) WOULD YOU PREFER
 TO BE A    LIBRARIAN (A), OR A
 SALESPERSON(B)?": GO SUB 600
2190 PRINT "13) WOULD YOU DESCRI
BE YOURSELF AS CAUTIOUS (A) OR O
UT-GOING (B)": GO SUB 600
2200 PRINT "14) WOULD YOU LIKE T
O BE A CIVILSERVANT (A) OR IN TH
E GOVERNMENT(B)?": GO SUB 600
2210 PRINT "15) DO YOU ENJOY BIG
, NOISY     PARTIES (B), OR NOT
(A)?": GO SUB 600
2220 PRINT "16) WOULD YOU FIND I
T DIFFICULT TO MAKE A PUBLIC SPE
ECH (A), OR EASY (B)?": GO SUB 6
00
2230 PRINT "17) IN A THEATRE WOU
LD YOU LIKE TO BE A STAGE-HAND (
A), OR AN    ACTOR (B)?": GO SUB
600
2240 PRINT "18) DO YOU HAVE A RE
ADY REPLY    FOR MOST CONVERSATIO
N (B), OR    ARE YOU MORE RESERVE
D (A)?": GO SUB 600
2250 PRINT "19) ARE YOU SLOW (A)
, OR QUICK   (B) AT MAKING NEW FR
IENDS?": GO SUB 600
2260 PRINT "20) WOULD YOU DESCRI
BE YOURSELF AS BEING FULL OF ENE
RGY (B), OR NOT (A)?": GO SUB 60
0
2270 PRINT  FLASH 1;AT 10,7;"TES
T NO.1 OVER!"; FLASH 0: GO SUB 5
0
2280 CLS : PRINT "RESULTS OF P.T
EST NO.1:"; OVER 1;AT 0,0;"______
_______________"''
2285 PRINT "YOU ARE ";
2290 GO SUB 800
2300 GO SUB 50
2310 GO TO 35
3000 REM PERSON. TEST NO.2.
3010 PAPER 6: BORDER 6: INK 0: B
RIGHT 0: CLS : LET PT2B=0
3020 PRINT "PERSONALITY TEST NO.
2:"; OVER 1;AT 0,0;"_____________
_______"''
3030 GO SUB 50
3040 PRINT "1) AS FAR AS YOU KNO
W HAVE YOU EVER (A) WALKED IN Y
OUR SLEEP,  OR NOT (B)?": GO SUB
 650
3050 PRINT "2) HAVE YOU BEEN OFF
 WORK DUE TOILLNESS FOR A TIME P
ERIOD LONGERTHAN MOST PEOPLE (A)
, OR NOT (B)": GO SUB 650
3060 PRINT "3) DO YOU HAVE A TEN
DENCY TO    FEEL CONFUSED IF INT
ERRUPTED     WHILST WORKING (A),
OR NOT (B)?": GO SUB 650
3070 PRINT "4) DO YOU ENJOY SOME
 HARD       EXERCISE EVERY DAY (
A), OR NOT   (B)?": GO SUB 650
3080 PRINT "5) THE LAST TIME YOU
 BEGAN TO   LEARN A NEW SKILL DI
D YOU FEEL   CONFIDENT (B), OR NO
T (A)?": GO SUB 650
3090 PRINT "6) HAVE YOU FELT STR
ONGLY ABOUT EVERYDAY IRRITATIONS
 (A) , OR    NOT (B)?": GO SUB 65
0
3100 PRINT "7) HAVE YOU EVER WOR
RIED FOR     HOURS AFTER A SITUAT
ION WHERE    YOU FELT HUMILIATED
(A), OR NOT (B)?": GO SUB 650
3110 PRINT "8) WOULD PEOPLE REGA
RD YOU AS A SENSITIVE PERSON (A)
, OR NOT (B)": GO SUB 650
3120 PRINT "9) DO YOU USUALLY GE
T TO SLEEP   EASILY (B), OR NOT (
A)?": GO SUB 650
3130 PRINT "10) WOULD MANY PEOPL
E CONSIDER   YOU SHY (A), OR NOT
(B)?": GO SUB 650
3140 PRINT "11) DO YOU FEEL DIST
URBED IF     SOMEONE YOU KNOW FAI
LS TO GREET YOU (A), OR NOT (B)?
": GO SUB 650
3150 PRINT "12) DO YOU (A) SOMET
IMES FEEL    HAPPY OR SAD WITHOUT
 ANY REAL    CAUSE, OR NOT (B)?":
 GO SUB 650
3160 PRINT "13) AT WORK DO YOU O
FTERN FIND   YOURSELF DAY-DREAMIN
G (A), OR    NOT (B)?": GO SUB 65
0
3170 PRINT "14) CAN YOU (A) REME
MBER HAVING ANY NIGHTMARES IN TH
E LAST FIVE YEARS, OR NOT (B)?":
 GO SUB 650
3180 PRINT "15) HAVE YOU A REAL
FEAR OF      HEIGHTS/TUNNELS OR O
UT-DOORS      (A), OR NOT (B)?": G
O SUB 650
3190 PRINT "16) DO YOU USUALLY B
EHAVE CARMLYAND EFFICIENTLY IN A
N EMERGENCY (B), OR NOT (A)?": G
O SUB 650
3200 PRINT "17) ARE YOU A VERY E
MOTIONAL     PERSON DURING NORMAL
 SITUATIONS (A), OR ARE YOU NOT
(B)?": GO SUB 650
3210 PRINT "18) DO YOU (A) FREQU
ENTLY WORRY ABOUT YOUR HEALTH, O
R NOT (B)?": GO SUB 650
3220 PRINT "19) CAN YOU REMEMBER
```

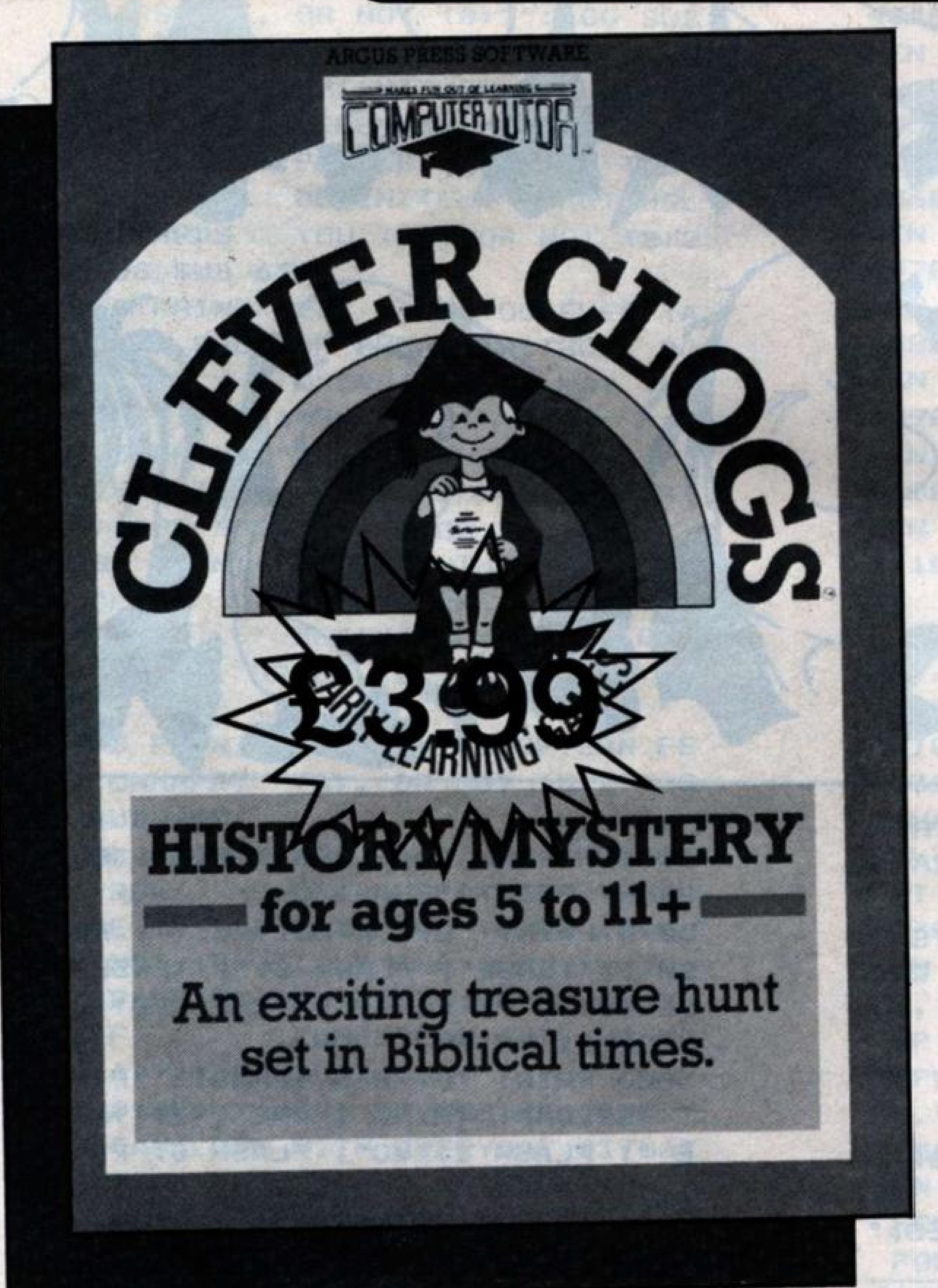
```
 DEFINITELY ANNOYING SOMEONE THI
S YEAR (A), OR NOT (B)?": GO SUB
 650
3230 PRINT "20) DO YOU SWEAT WIT
HOUT DOING  MUCH EXERCISE (A), O
R NOT (B)?": GO SUB 650
3240 PRINT "21) CAN YOU REMEMBER
 YOUR MIND  GOING BLANK WHILST D
OING A JOB  DURING THE LAST FIVE
 YEARS (A), OR NOT (B)?": GO SUB
 650
3250 PRINT "22) WITHIN THE LAST
YEAR CAN YOUREMEMBER MEETING AT
LEAST THREE PEOPLE THAT YOU THOU
GHT WERE    DEFINITELY UNFRIENDL
Y TOWARDS   YOU (A), OR NOT (B)?
": GO SUB 650
3260 PRINT "23) HAVE YOU EVER (A
) BEEN SHORTOF BREATH WITHOUT DO
ING ANY     EXERCISE, OR NOT (B)
?": GO SUB 650
3270 PRINT "24) ARE YOU USUALLY
TOLERANT OF OTHER PEOPLE'S WAYS
(B), OR NOT (A)?": GO SUB 650
3280 PRINT "25) ARE THERE ANY NO
RMAL        SITUATIONS WHERE YOU
 FEEL       DEFINITELY SELF-CONC
IOUS (A), ORNOT (B)?": GO SUB 65
0
3290 PRINT "26) DO YOU OFTERN FE
EL UNHAPPY  (A), OR NOT (B)?": G
O SUB 650
3300 PRINT "27) HAVE YOU SUFFERE
D FROM      DIARRHOEA MORE THAN
ONCE IN THE LAST TWO YEARS (A),
OR NOT (B)?": GO SUB 650
3310 PRINT "28) ARE YOU USUALLY
SELF-       CONFIDENT (B), OR NO
T (A)?": GO SUB 650
3320 PRINT "29) DO YOU BELIEVE Y
OU CAN COPE WITH EVERYDAY SITUAT
IONS AS WELLAS ANYONE ELSE (B),
OR NOT (A)?": GO SUB 650
3330 PRINT "30) DO YOU USE ASPIR
IN/SLEEPING-TABLETS OR TRANQUILI
ZERS MORE   THAN ONCE A MONTH (A
), NO:(B)?": GO SUB 650
3500 PRINT  FLASH 1;AT 10,7;"TES
T NO.2 OVER!"; FLASH 0: GO SUB 5
0
3510 CLS : PRINT "RESULTS OF P.T
EST NO.2:"; OVER 1;AT 0,0;"
_____________________"''
3515 PRINT "YOU ARE ";
3520 GO SUB 900
3530 GO SUB 50
3540 GO TO 35
4000 REM IQ. RESULT.
4010 PRINT "I.Q. TEST RESULT:";
OVER 1;AT 0,0;"________________"
''
4015 IF SCORE=0 THEN  LET IQ=80
4020 IF SCORE>0 AND SCORE<=5 THE
N  LET IQ=85+(2*SCORE)
4030 IF SCORE>5 AND SCORE<=12 TH
EN  LET IQ=INT (95+(2*(SCORE-6))
)
4040 IF SCORE>12 AND SCORE<=18 T
HEN  LET IQ=INT (104+(2*(SCORE-1
2)))
4050 IF SCORE>18 AND SCORE<=25 T
HEN  LET IQ=114+(SCORE-18)
4060 IF SCORE>25 AND SCORE<=30 T
HEN  LET IQ=120+(SCORE-25)
4070 IF SCORE>30 AND SCORE<=35 T
HEN  LET IQ=125+(SCORE-30)
4080 IF SCORE>35 AND SCORE<=40 T
HEN  LET IQ=130+(SCORE-35)
4090 IF SCORE>40 AND SCORE<=45 T
HEN  LET IQ=135+(SCORE-40)-1
4100 IF SCORE>45 AND SCORE<=49 T
HEN  LET IQ=138+(SCORE-45)-1
4110 IF SCORE=50 THEN  LET IQ=14
2
4120 PRINT "YOUR SCORE IS ";SCOR
E;"/50"''
4125 PRINT "YOUR I.Q. RESULT IS
";IQ''
4130 IF SCORE>=40 THEN  PRINT "P
ERHAPS YOU SHOULD THINK ABOUT  A
PPLYING TO JOIN MENSA!        T
HAT WAS AN EXCELLENT SCORE."
4140 IF SCORE<40 AND SCORE>=30 T
HEN  PRINT "THAT WAS A GREAT SCO
RE,       WELL DONE! NOT QUITE
 UP TO MENSASTANDARDS BUT IN THE
 UPPER 10%  AREA OF THE POPULATI
ON."
4150 IF SCORE<30 AND SCORE>=25 T
HEN  PRINT "THAT WAS A VERY GOOD
 SCORE. IN  THE UPPER 15% OF THE
 POPULATION."
4160 IF SCORE<25 AND SCORE>=20 T
HEN  PRINT "GOOD SCORE. WELL ABO
VE THE      POPULATION AVERAGE."
4170 IF SCORE<20 AND SCORE>=15 T
HEN  PRINT "FAIR SCORE, JUST ABO
VE THE      POPULATION AVERAGE."
4180 IF SCORE<15 AND SCORE>=8 TH
EN  PRINT "AVERAGE SCORE, WITHIN
 THE 68% OFTHE POPULATION BRACKE
T."
4190 IF SCORE<8 AND SCORE>=5 THE
N  PRINT "POOR SCORE. BELOW THE
POPULATIONAVERAGE."
4200 IF SCORE<5 AND SCORE>=1 THE
```



```
N  PRINT "VERY POOR. WITHIN THE
LOWER 16% OF THE POPULATION RANG
E!"
4210 IF SCORE=0 THEN  PRINT "SUP
ER CRETIN! YOU GOT THEM ALL  WRO
NG."
4220 GO SUB 50
4230 RETURN
5000 REM IQ. TEST EXAMPLES.
5010 INK 0: PAPER 6: BORDER 6: B
RIGHT 0: CLS
5020 PRINT "I.Q. TEST EXAMPLES:"
; OVER 1;AT 0,0;"________________
___"''
5030 PRINT "A) ANALOGIES:"''"DARK
 IS TO LIGHT AS X IS TO Y:  (";
FLASH 1;"BLACK"; FLASH 0;", TREE
, PLANT, "; FLASH 1;"WHITE"; FLA
SH 0;")"''
5040 PRINT "B) SIMILARITIES:"';
FLASH 1;"ENTIRE"; FLASH 0;", WID
E, EMPTY, "; FLASH 1;"WHOLE"; FL
ASH 0: PRINT
5050 PRINT "C) EQUATIONS:"''"21-6
=3*(A) "; FLASH 1;"5"; FLASH 0:
PRINT
5060 PRINT "D) LINKS:"''"INVOICE
(B**L) BEAK "; FLASH 1;"IL"; FLA
SH 0: PRINT
5070 PRINT "E) OPPOSITES:"'; FLA
SH 1;"TENSE"; FLASH 0;", TERSE,
SERIOUS, "; FLASH 1;"RELAXED"; F
LASH 0: PRINT
5080 PRINT "F) MID-TERMS:"'"FIRS
T (SECOND) THIRD : ONE (T**)THRE
E "; FLASH 1;"WO"; FLASH 0: PRIN
T
5090 GO SUB 50: CLS
5100 PRINT "G) SIMILAR/OPPOSITES
:"'; FLASH 1;"PUNISH"; FLASH 0;"
, REPUTE, REPLY, "; FLASH 1;"REW
ARD"; FLASH 0: PRINT
5110 PRINT "H) MATHS MID-TERMS:"
'" 11 (12) 13 : 4 (A) 6 "; FLASH
 1;"5"; FLASH 0: PRINT
5120 GO SUB 50
5130 GO TO 35
9990 REM SAVE ROUTINE.
9998 CLS : PRINT "SAVE:": SAVE "
I.Q. TEST." LINE 1: CLS : PRINT
"VERIFY:": VERIFY "I.Q. TEST.":
CLS : PRINT "O.K.": STOP
9999 REM LISTING OCCUPIES 34.5K.
```



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With initial help from Mum and Dad tiny tots will love to play these party games. They can blow out the candles on the cake, sing along with nursery rhymes, even draw on the screen. Letters and numbers are taught the fun way. Watch your whizzkids develop new skills and learn how to use a computer.
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. . . . copies of Star Trucker

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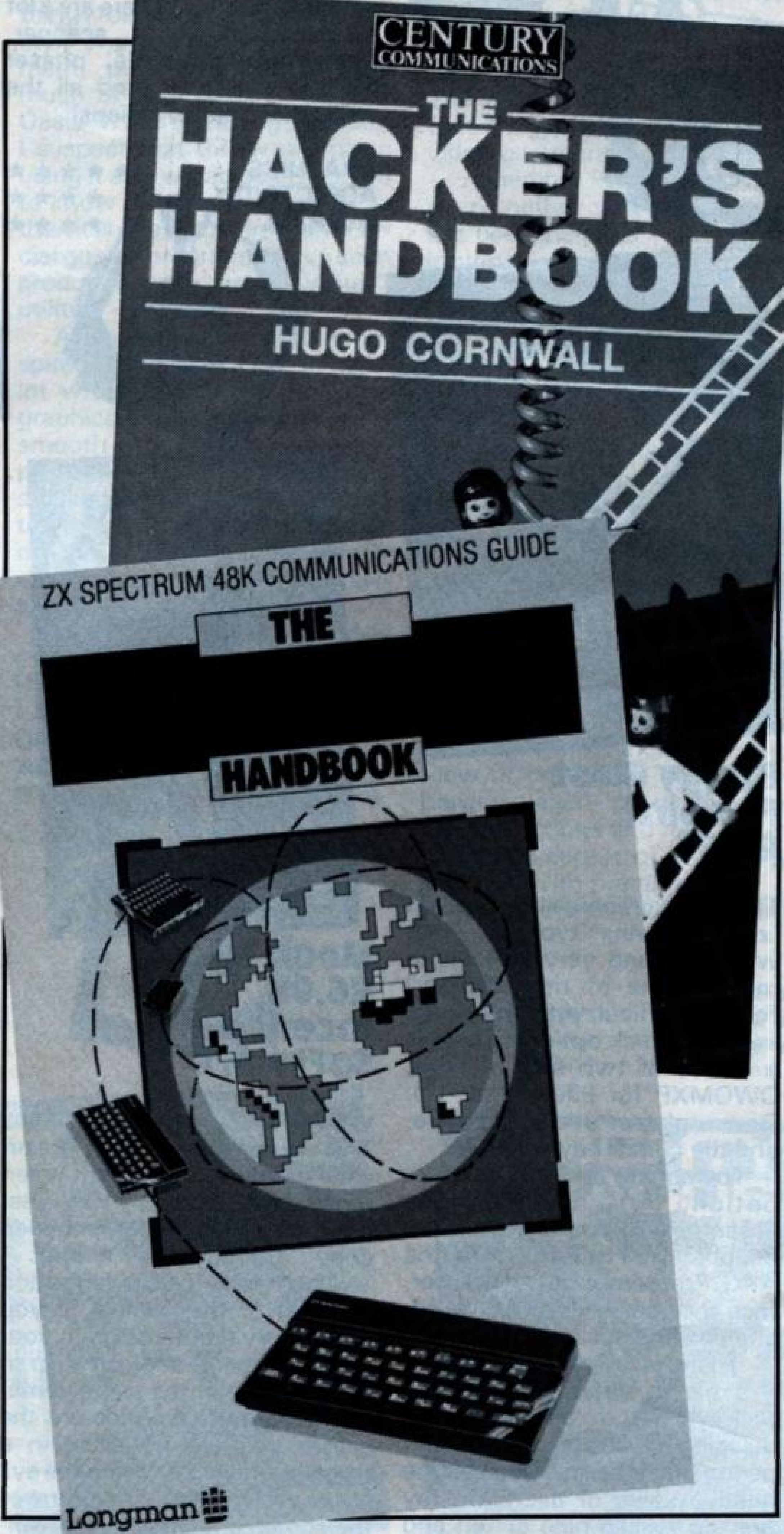
Bookshelf

This issue, we look at The Hacker's Handbook — both of 'em!

It's nice to see some computing books coming out that aren't just variations on the '25 Spiffing Games/Machine Code for Morons' format.

April saw two new releases for those who want to explore the communications abilities of their machines. Coincidentally, they were both called The Hacker's Handbook (which may make this review a bit confusing) but they take quite different views of the subject of hacking itself. The first, published by Century Communications and written by Hugo Cornwall (an alias, of course) explores the glamorous semi-legal aspect of hacking and caused a certain amount of controversy when published, with 'a top Scotland Yard Detective' declaring 'no good can come of anything in this book.' This of course will probably do wonders for sales but wether or not the criticism will be proven true remains to be seen.

Admittedly, the book does give detailed accounts of events such as 'The Great Prince Philip Prestel Hack' and even of bugs in those hole-in-the-wall cash dispensers, so I suppose that the Police concern is not entirely without justification of some sorts. The problem here is that theft of information is not illegal, mainly because the law hasn't yet caught up with recent advances in information technology — it could certainly be argued though, that breaking into private files is immoral and ought to be illegal. But here, the book's author adheres to the view of the Hacker as a sort of computerised Raffles — more interested in the challenge of a good break-in than in material gain, and having a strict code of honour. 'Hackers' he tells us, 'should not be interested in fraud.'



It's a matter of semantics really, but a Hacker, according to Cornwall's definition is not interested in criminal activities, therefore anyone who does embark on hacking with criminal intent is not a Hacker, but a criminal. Still, the ethics of hacking aside, the Century Handbook is a very good read. It is, I think a little too technical in places for the beginner (I got lost on several occasions whilst reading it), and probably requires some experience with modems and knowledge of things like protocols in order to get the best of the book. Even so it is much better written than the average computer book. The author's style is clear and uncomplicated and his enthusiasm for the subject carried me through the technical bits that went over my head. Well worth buying.

The second Hacker's Handbook, published by Longman and written by Geof Wheelwright and Ian Scales is probably required reading for anyone who wants to read the Cornwall Handbook. Subtitled the 'ZX Spectrum 48K Communications Guide' it is a machine-specific introduction to the subject and actually explains all the technical bits that I didn't understand in the first book. The page layout is quite useful in that the margins carry brief explanations of any jargon that may appear in the main text. Starting absolutely from first principles with a chapter entitled 'Why Communicate?' the authors assume no prior knowledge of the hardware, software and facilities available. This Handbook though, is not concerned with breaking into other people's systems and deals only with the 'legitimate' services available quite freely to anyone.

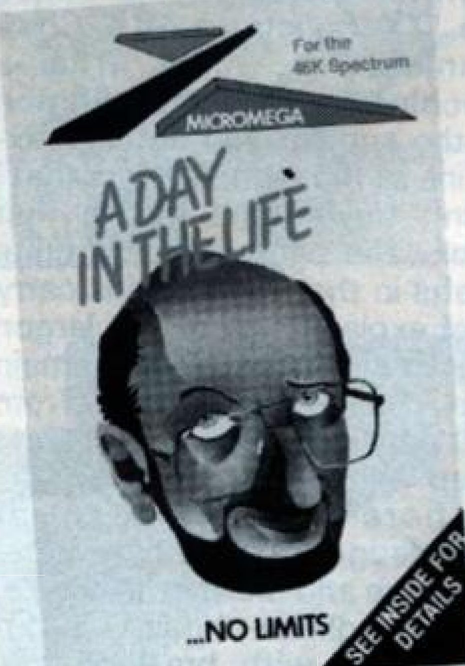
There are chapters on Prestel and Micronet, Bulletin Boards, various types of electronic mail, and, thank heavens, a gentle introduction to modems and interfaces (ok, hands up everyone, me included, that has seen the legendary RS232 interface referred to all over the place — even on Spitting Image — but never had the faintest idea what the damn thing actually does). The authors' style is a little drier than Cornwall's but as they had a lot of explanatory material to present, that was probably inevitable.

It is interesting to compare the attitude that this book takes to the kind of hacking that Cornwall deals with. This, the authors tell us, is increasingly becoming an activity for professional criminals, whereas the 'sporting activity' that Cornwall discusses is now the exception rather than the rule. This is a debate that will go on for ages, and if you want to be in on it, then I can recommend both these books to you, though I should add that for the beginner the Longman Handbook is probably the more essential of the two, and provides the experience and information that you will need to fully appreciate the Century Handbook. **S.D.**

Title: The Hacker's Handbook
Author: Hugo Cornwall
Publisher: Century Communications
Price: £4.95

Title: The Hacker's Handbook
Author: Geof Wheelwright and Ian Scales
Publisher: Longman Software
Price: £5.95

We the jury . . .





A Day In The Life
£5.95
Micromega

A humorous game dedicated to "the man who put us all into business", this has you guiding the Head of Sinclair around several screens of objects to collect and people to avoid. An unusual combination of platform and maze games and all in a 3D perspective.

The graphics looks sparse in comparison to some games on the market, but after a few plays I came to appreciate the uncluttered display — simple in concept it may be, but simple to play it is not. A nice sense of humour runs throughout, and I even found the insert notes funny.

The object of the game is to get Clive to Buck House to be invested as Dame Commander of the British Empire, you start in his house in bed and have to get clothes and a key to get out, avoiding the animated TV, Spectrum, cat (so far it's just like home — Ed.) and the bug in the attic. Objects bounce off each other and just as you think you've got it sussed they collide and come back unexpectedly — exit one of your five lives. Scoring is simply calculated by the time in which you complete each screen and the top score is kept and displayed.

I liked it but found it frustrating as it looked so easy, probably Underwurlde experts may find it rather easy, but for most of us the difficulty is just right, making you want just ONE more go.

Micromega, 230-236 Lavender Hill, London SW11.

GRAPHICS ★★★★
ADDICTIVITY ★★★★★
OVERALL ★★★★



Buggy Blast
Firebird
£5.95

This is a graphically excellent 'zap the aliens' type of game, which I found very difficult to master. One of the reasons I found it difficult was that there are no joystick options. There is a choice of two sets of keys, OWOMXP for Life, Right, Up, Down, phaser and normal fire, and the cursor keys plus X.

I personally preferred the first option, but, although the cassette tells you to remove all peripherals, I tried it with the AKG Protocol 4 joystick interface and guess what? It worked. Life became easier.

There is a lot happening in this game, different aliens attack you from all sides, and deciding which one to try and hit needs quick assessment of the relative value of each. On my first go I killed nine or ten and scored nothing! This is a full blooded program and it is quite hard to score in the early stages — it's not for those who give up easily or want a purely mindless slaughter of offending aliens. Experienced players may find this challenge will keep them on their toes for some time.

Your task is to progress through eight sectors which are variations on the corridor flying theme, finally destroying 20 Lurgons in that sector in order to cause a power reversal which will destroy them. There are a lot of things to watch, scanner, computer, life mode, phaser lights and energy, and all the while the attacking aliens!

GRAPHICS ★★★★★
ADDICTIVITY ★★★★
OVERALL ★★★★



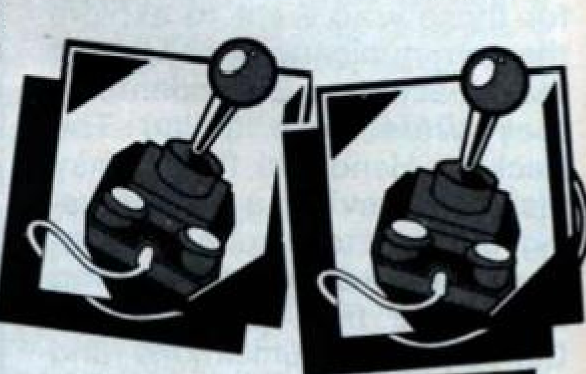
Moon Cresta
£6.95
Incentive Software

WOW!
This was one of my favourite arcade games and I thought when I saw the adverts "Oh yes, another inferior, highly hyped copy", but boy was I wrong!

This has all the challenge and features of the original, if you want to try it out just go to your nearest arcade and put 20p in the machine of the same name. Even the music/sounds are the same. You are travelling in a three-stage rocket when the evil aliens materialise in the centre of the screen and attack in a swirling pattern. Hit them and they split into two, hit them again and they die, destroy them all and another wave appears. After five waves the second stage of your rocket appears, and if you successfully dock with it you continue with twice the firepower (you'll need it!).

In the next section the aliens materialise, nip backwards and forwards before finally making kamikaze dives on you. The play levels are perfect, you can achieve reasonable success in the first few attempts and this will encourage you to try for a higher position in the high score chart. You just KNOW you'll do better next time. As a pure zap 'em all space game it is one of the best, a must for arcade enthusiasts.

GRAPHICS ★★★★★
ADDICTIVITY ★★★★★
OVERALL ★★★★★





Brian Bloodaxe
£5.95
The Edge

The first ever game to feature "Primary Imbalance" quoth the insert. I still don't know for sure what it is but I hazard a guess that it is the silly/unlikely solutions to the problems such as walking on the Shark's fin!

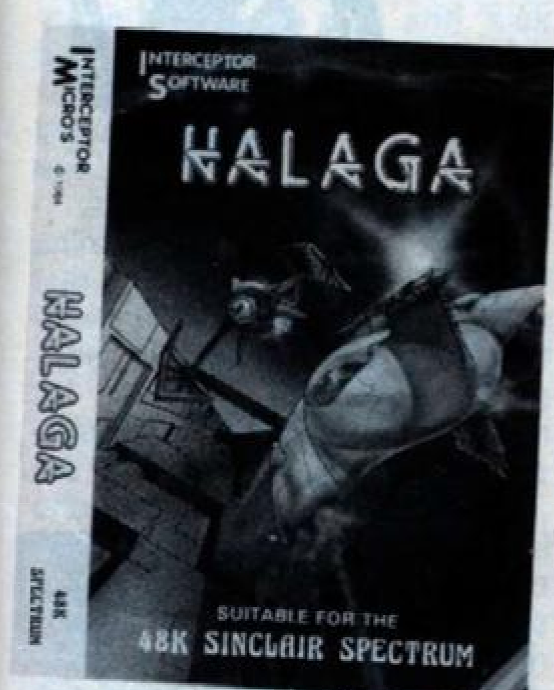
You as Brian, have invaded the Brits in 1983, you have to wander round collecting and using objects until you get the crown jewels and sit on the throne. Once you have done that then the insert notes say the REAL task of the game will be explained.

This is a platform and jump type program but with a style of its own. It is unfair to categorise it more than generally, each screen is carefully laid out in line with the plot, although no attempt to stay in a logical time sequence has been made — Nights and Cruise missiles in the same game!

The animation is very good, movements and jumps must be timed accurately, I'm afraid that I didn't get very far before I had to write this review, but it is one that I shall be going back to. There is a great deal of influence from the Monty Python team in the (il)logic of this program, this is implicitly acknowledged in the cassette picture and the ear curdling music. It was not hard to get started, however I soon got stuck only a couple of screens into the 100 that are there to be explored. Quite often I found myself sitting and trying to puzzle out the next move, not too successfully in most cases — although I enjoy adventures, some of the logic baffled and exasperated me!

GRAPHICS	★★★★
ADDICTIVITY	★★★★
OVERALL	★★★★





Halaga
£5.95
Interceptor Software

Sent to Cygnus Major for mineral resources by the Federation of Space Research, you run into a hostile alien reception. Only your skill with the anti-matter plasma gun will save you.

This is an average shoot 'em up space game which you can play with most of the joystick options available. The aliens zoom onto the screen in set patterns, take up their positions while the next squadron enters, and finally, when they are all in place, make bombing runs on your spaceship. As they enter and attack they send down a stream of missiles.

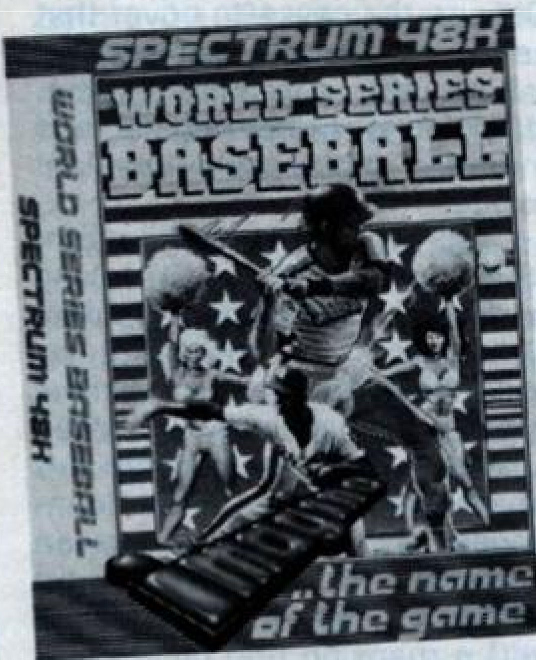
Simply by dodging back and forward and firing continuously I got through the first few sheets, (there are four screens to a sheet), before the speed of the attackers increased to such a rate that I couldn't survive. One thing I found interesting was the style of presentation and movement, this reminded me very much of the Demo screens of Oasis' White Lightning program. I suspect that this was written using it and would be interested to know if this is the case. If so then it is one of the first commercial quality programs I have seen produced by a "games writer" utility.

Although not particularly inspired or inspiring there is not a lot wrong with this game, the graphics are good, movement is smooth and it is enjoyable to play. I suppose that it lacks sophistication when compared to other programs. I played it for over an hour but have not really experienced a desire to have another go.

Interceptor Software, Lindon House, The Green, Tadley, Hants.

GRAPHICS	★★★★
ADDICTIVITY	★★
OVERALL	★★★





World Series Baseball
£6.96?
Imagine

Imagine do for Baseball what Psion did for tennis!

If you like sporting action simulations or even if you haven't up to now, this is a must as it provides all the best in computer graphic sports actions. Baseball is very similar to Rounders which most of us have played at some time. This game allows you to play either the computer or an opponent, using the keyboard or a Sinclair type twin joystick interface.

There are not many two player interactive games around and this is strange considering that the game that started the video game craze was just that — remember Pong? Just about every option you can think of has been included — number of innings per game, difficulty level, select playing keys, names and team colours. Each team takes a turn to bat and field. The normal rules apply, three strikes, run out or touched gets a player out, getting round the bases, either in one go or in stages scores a run.

The screen display is nothing short of brilliant! The top third shows the crowd with a huge display type billboard which at various times shows close ups of the pitcher, batsman or even cheerleaders, as well as the scores and advertisements for various companies. The bottom two thirds show a 3D bird's-eye view of the whole field. When playing, each player controls various actions and men in turn and a real degree of skill can be acquired with practice.

Imagine is dead, long live Imagine!

GRAPHICS	★★★★★
ADDICTIVITY	★★★★★
OVERALL	★★★★★



The Mighty Magus
Quicksilva
£7.99

If it wasn't for one absolutely unforgiveable design flaw, then I would give The Mighty Magus an unqualified 'thumbs-up', but as it is, that one flaw spoils the game.

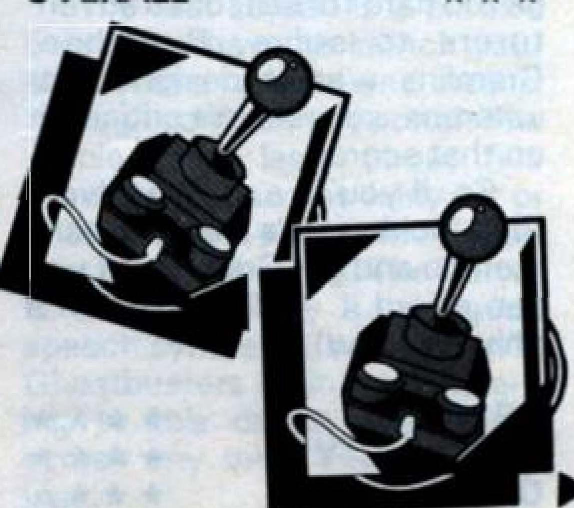
You play the part of the aforesaid Magus. Starting at the topmost level of an underground dungeon, you must penetrate deep into the lowest levels to face your arch enemy, Fraug the Dragon. As you descend, you can move around various sets of stairs and platforms, and use a SEARCH option to look for useful objects along the way. You begin with a certain amount of power and magic which are depleted by falls from platforms and magical combat with the denizens of the dungeon but can be boosted by things you find along the way.

These underground monsters are well animated, though your own movement and the scrolling dungeon layout are fairly jerky. Also, some of the traps on the dungoen floor are quite difficult to avoid as they often look no different from the normal, safe, floor tiles.

I was really enjoying playing this game until the fatal flaw that I mentioned earlier became apparent. The dungeon layout is randomly generated, which is fine as it provides plenty of variation but the drawback to this is that very often you can drop into a dead-end and find yourself with no way out. This means that you simply have to abort and start the game again from the beginning. This, as I said, is an unforgivable oversight, and makes the game incredibly frustrating. Surely some sort of check could have been built into the game to prevent this?

Mighty Magus is (or rather, could be) a very good game, but the 'dead end' syndrome could well result in the cassette being thrown out the window in frustration. It's up to you to decide if you're prepared to risk it.

GRAPHICS	★★★★
ADDICTIVITY	★★★
OVERALL	★★★





Gremlins Adventure International £9.95

Following their Marvel Comics tie-in series, Adventure International have now moved into the film world with a game based upon the Christmas hit, Gremlins.

Gremlins is a sort of introductory adventure aimed at people who may not have played adventure games before, but who may be attracted to this game having seen the film. And anything which helps to make adventuring more popular is to be welcomed.

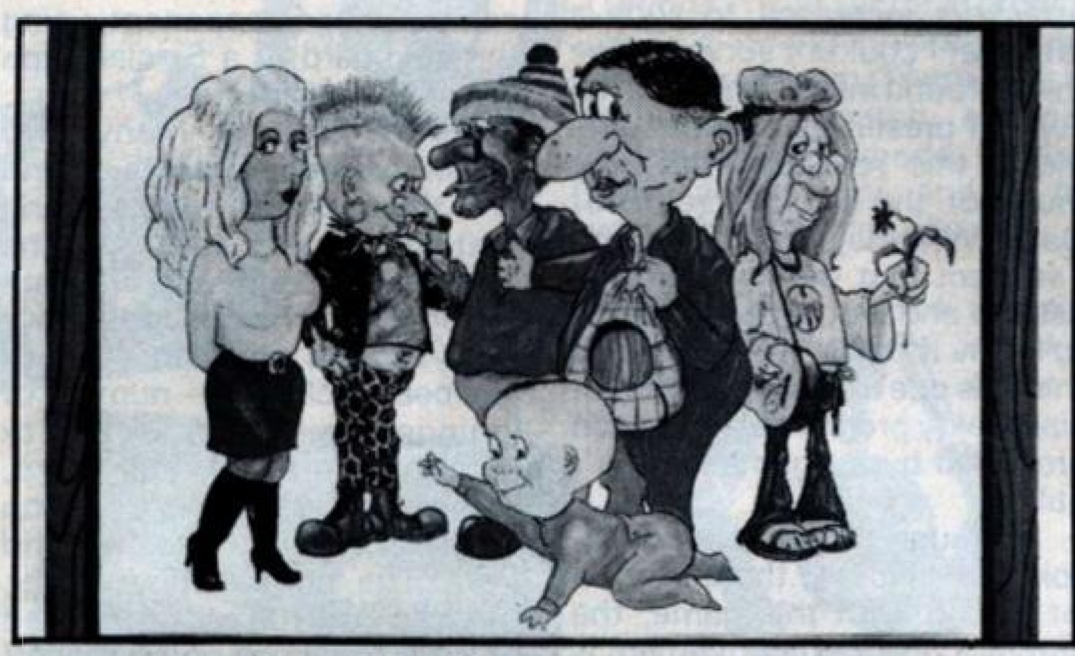
The sentence parser is very sophisticated, and the graphic drawings of the locations are excellent. As well as being highly detailed and colourful (the picture of Gizmo is sooo cute!), the graphics also feature a limited animation. In one scene, there is a 'flashing' Gremlin, just as in the film, and the pictures change in response to your commands - in one location, the command 'Kill Gremlin' results in a picture of a headless Gremlin being added to the scene.

The quality of the graphics and parser are just the sort of thing that will encourage the first-time adventurer to get to grips with the techniques of this type of game, but they have taken a toll on the memory available, so that there are relatively few locations to explore, and the problems will not be too hard for seasoned adventurers to solve. But then, Gremlins wasn't designed for veterans, so we can't criticise it on that score.

So, if you're a novice adventurer looking for a place to start, then go and get Gremlins (if you can afford it — the price is it's only real flaw).

GRAPHICS	★★★★
ADDICTIVITY	★★★★
OVERALL	★★★★





Everyone's a Wally Mikro-Gen £6.95

Mikro-Gen's Wally games seem to be taking on a life of their own and multiplying to form a whole series of games. However, if they're all as good as Everyone's A Wally, then I shan't be complaining.

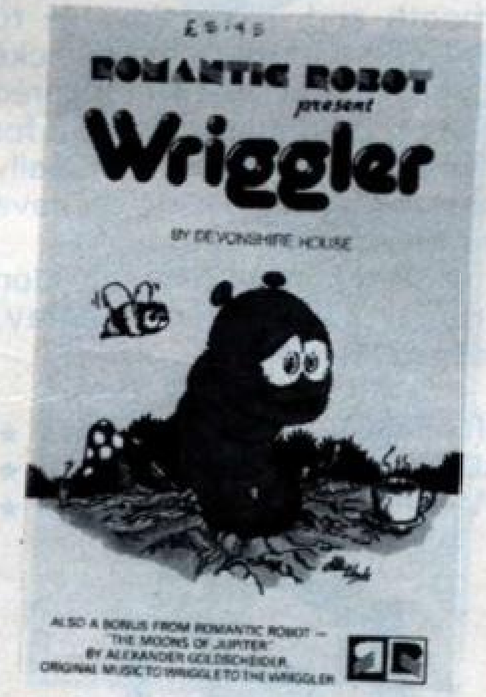
Unlike any other arcade or adventure type game, this one allows you to control more than one character — you can choose between Wally himself, Thelma his wife and the rest of the cast of thousands (well, six actually). As all these characters wander around town they must figure out how to complete various tasks, eventually opening a safe to get at their wages.

The locations in the town are all well drawn, and contain some interesting surprises. On one occasion I took Wally into a telephone box and ended up playing some sort of Asteroids game!

The animation of all the characters is very good. They are all drawn in big chunky sprites and really do 'walk' rather than just wiggling their legs. The inevitable colour clashes occur, but the characters always remain clearly defined and solid-looking. To be honest, I've not made much of a dent in the game so far as the instructions don't give too much away. But this is intentional of course, for, as with Ultimate's games, half the fun lies in figuring out the mechanics of the game and what you are supposed to do with all the objects that you come across.

I understand that Mikro-Gen's next offering will be a game based on Wally's son, Herbert. I look forward to it with quivering anticipation.

GRAPHICS	★★★★★
ADDICTIVITY	★★★★
OVERALL	★★★★★



Wriggler Romantic Robot £6.95

Despite the cassette cover that seems to promise yet another 'shoot the catepillar' game, Wriggler is more original and more fun to play than you might expect.

You play the part of a worm (that's novel for a start) taking part in a race around a garden. The garden is populated by assorted nasties, ants of various types and a superbly animated spider that is instant death if it touches you. Beyond the boundaries of the garden are an underground labyrinth and (although I haven't found them yet) a mansion and planet surface, so there's plenty of scope for wandering around and exploring.

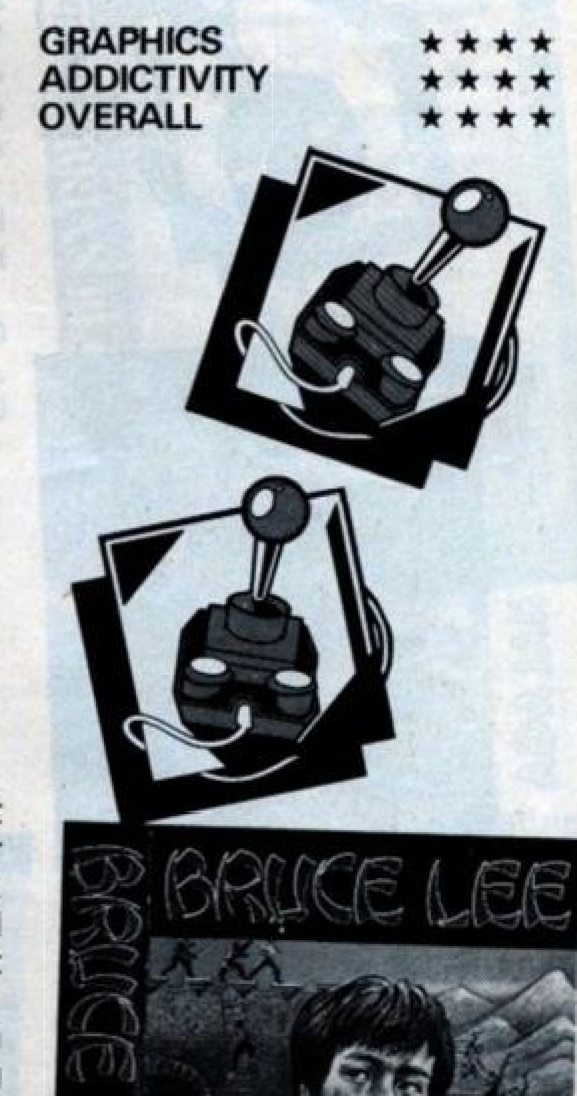
Scattered along the way are various items including food to keep you going, ant sprays for when you're caught in a tight spot, extra lives, and even a parachute. All the graphics are well drawn and the animation is very smooth. Even the movement of the Wriggler is novel in that rather than just moving left/right/up/down, you have to adopt a sort of wriggly side-to-side movement if you want to move quickly.

The only minor irritation that I found was the tune that played after losing a life. Why do programmers insist on using these silly little tunes? Nobody likes them and they only slow the game down while you're waiting to get on with it.

Still, that aside, I enjoyed Wriggler and will be going back to it, to try and find the rest of the locations. It's just that little bit different from the rest of the current crop and well worth buying.

P.S. I'd just like to thank RR for the cute fluffy toy they sent along to publicise the game which has proved very popular in the ZX offices.

GRAPHICS	★★★★
ADDICTIVITY	★★★★
OVERALL	★★★★





Bruce Lee US Gold £7.95

I enjoyed playing this quite a lot. Basically, it's just a glorified plat-

form game in which you, Bruce Lee, have to go through the chambers of a Wizard's fortress collecting lanterns which will enable you to continue deeper into the fortress and eventually confront the Wizard himself.

But, what makes this so much more fun than the average platform game is the presence of your two foes, the Ninja and the wobbly Samurai called the Green Yamo. In most games of this type, the monsters which you must avoid are simply sprites moving in a fixed pattern. However, in this game, the Ninja and Yamo are fully animated opponents who chase you all around the temple, the Ninja bashing you over the head with his broken stick, and the Yamo leaping at you with a flying kick.

Of course, you can retaliate with flying and karate chops of your own, and I must admit that I found this the most enjoyable aspect of the game. Working out how to get through the fortress chambers isn't terribly hard, but watching as your Bruce Lee figure leaps across the screen and kicks the Yamo all around the floor is great fun. I got my younger brother to play, using the two player option, and the house resounded to cries of 'poke him in the eye' and 'kick his head in!', until well after midnight. It's all terribly childish, I know, but great fun nonetheless.

All the figures are very nicely animated and detailed, and you can make out who's who even when they're all on top of each other, kicking and punching for all they're worth. The chambersthat you pass through are all well designed, and the oriental designs make a nice, colourful change from the usual type of graphics in platform games. My only criticism of the game is that your path through the fortress is fixed unlike the rooms in JSW which allow you to take any path through the house that you want. Consequently, after a few games it can get a bit boring having to go through the same route time after time, but this is where the combat saves the game from getting stale. Of course, if the fortress were more complicated then the memory wouldn't be available for the combat and animation, so the game as it is probably struck the right balance. Definitely worth getting, I think.

GRAPHICS	★★★★
ADDICTIVITY	★★★★
OVERALL	★★★★



Stay Kool
Bug Byte
£6.95

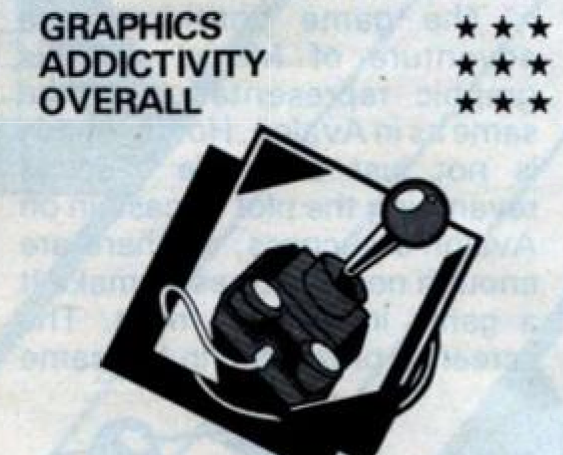
Chuckie Egg 2 managed to add a couple of new features to the standard platform format, but Stay Kool is about as unoriginal an addition to the hordes of JSW clones as you can get. In fact, you could even say that it's more of a Manic Miner clone than of the more modern JSW. There is one room in Stay Kool that is more or less a straight copy of one in MM (I think it was called Return of the Kong Beast, or something like that).

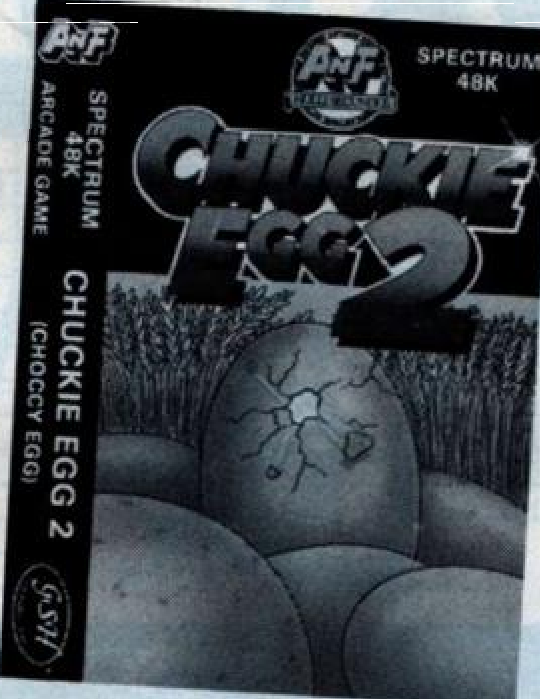
Even the graphics are a step backwards, for although the various 'monster' sprites are animated adequately the figure of Luke Warm (the hero of the piece) is pretty slow moving, and very flickery.

The plot of the game, such as it is, is that Luke's *spaceship* has been damaged in a battle and that Luke, in order to launch his escape pod must rush around the ship collecting fuel pods before the ship overheats. The logic of all this seems pretty dubious when you actually see the sort of rooms that the ship contains, but what the heck, it's only a game.

Most of the rooms are quite well designed, being hard enought to require a bit of thought, but not so hard that you die instantly. And, as in JSW, you don't have to collect the objects in each room before moving on to the next, so if an object seems too hard to reach you can carry on exploring and come back later. And, as a matter of fact I did find the game interesting enough to want to carry on wandering through the rooms. Despite the simplicity of the game it is well enough designed to hold my attention. In fact, it's not a bad game at all really, it's just that it's so clone-like that I can't really get very excited about it. If it were a budget game say, £1.99/£2.50 it would be excellent value, but for £6.95 it's not top of my shopping list.

GRAPHICS	★★★
ADDICTIVITY	★★★
OVERALL	★★★





Chuckie Egg
A & F Software
£6.90

At long last the sequel to one of my all time favourite games has arrived. At first I was a bit disappointed to see that all the cute ducks and hens of the original game had been abandoned in favour of a more conventional platform game arrangement. But, Chuckie Egg 2 (or Choccie Egg as it is cutely subtitled due to its Easter release date) is still very enjoyable.

You must move Henhouse Harry around a large factory (120 rooms) and collect the ingredients to make Easter Eggs. Along the way you will meet manic hoovers, shaggy dogs, moles and other assorted deadly sprites. In addition, Chuckie Egg 2 has an arcade/adventure element that allows you to carry various objects (normally only two at a time) that you will need to solve some puzzles (for instance, in order to get past the shaggy dog, you must first collect a bone to distract him with).

Another adventure-type element is the inclusion of a SAVE game facility that comes in very handy. If you come across any screens that look too tricky, you can just SAVE the game position, try to navigate the new screen, and, if you lose all your lives, you can just reload the SAVEd game and try again.

The graphics are quite good, some of the sprites are very good, but the attribute problems of the original are still present and Harry himself seems to move rather more slowly than he used to (getting old perhaps?). But all things considered, if you're in the market for yet another platform game you could do worse than taking a bite out of Choccie Egg.

GRAPHICS	★★★★
ADDICTIVITY	★★★★
OVERALL	★★★★



Death Star Interceptor
System 3 Software
£7.95

Some of the more game orientated 'zines have been raving about this, but I can't really see what all the fuss is about I'm afraid. Death Star Interceptor is a very competent piece of programming, but apart from the third screen it's really just space invaders with souped-up graphics.

The first screen is a bit of a bore. You have to launch your ship from a runway and steer it through some sort of portal. The whole thing lasts about five seconds and seems fairly hit or miss, as the ship rather overreacts to its controls. The launch is announced by some good speech synthesis, better than in Ghostbusters I think, but listening to this doesn't make the screen any more interesting to play. ▶

The second screen is the Space Invaders Bit. The graphics are excellent, no doubt about it. The attacking ships start off as points moving against the starry background and growing and taking on shape as they zoom in on you, but you are still just stuck moving your ship left and right (with a small room for up and down movement) at the bottom of the screen, space invaders style.

The third screen is far and away the best. The action for once matches the graphics as you zoom along the trench searching for the Death Star's weak spot. The perspective graphics are excellent and the chase through the trench gets pretty frantic.

If you're looking for a shoot 'em up, them I suppose that this or Incentive's Moon Cresta are the zap games of the moment, but I'm afraid that for me the trench sequence on this just didn't make up for the other screens that you have to go through first.

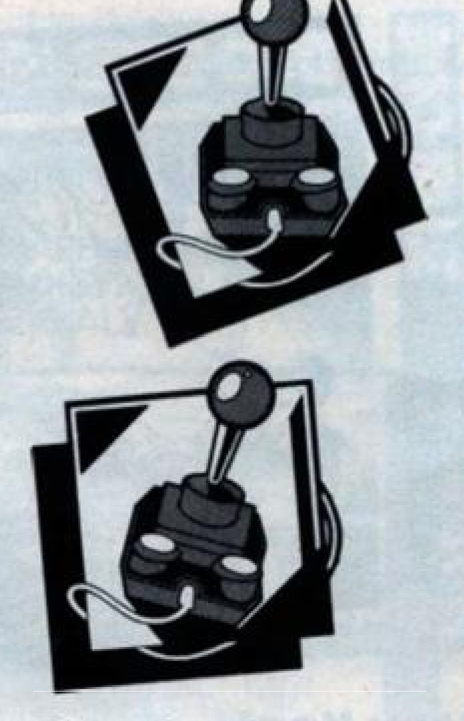
GRAPHICS	★★★★
ADDICTIVITY	★★★
OVERALL	★★★

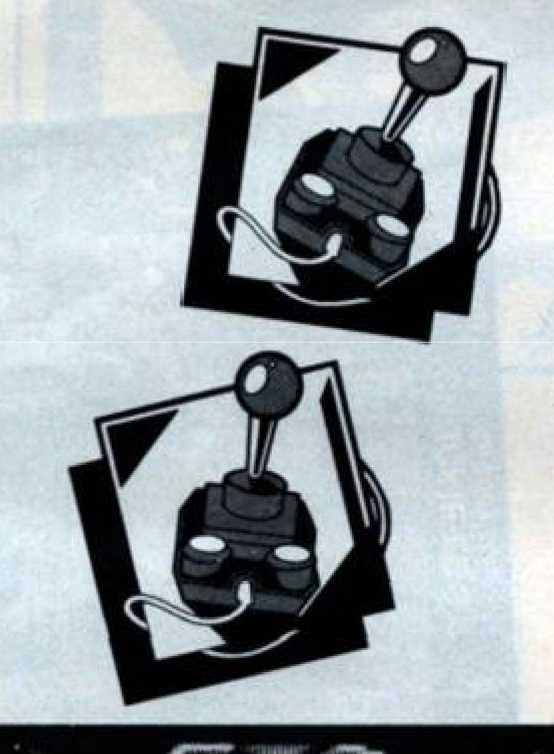


Dragontorc
Hewson Consultants
£7.95

The amazing thing about this is not the graphics, which are superb, the sound which is very good, or the plot which is extremely challenging, but the subtlety and range of control which is possible using only five controls either via a joystick or the keyboard.

The game continues the adventure of Maroc and his graphic representation is the same as in Avalon. However this is not just a simple case of revamping the plot to cash in on Avalon's success, as there are enough new features to make it a game in its own right. The screen is presented in the same way as Avalon, 3D perspective with the scroll at the bottom for messages and options. One of the new features is "Sensory Animation" which makes the characters react to you depending on how you act towards them. Most are initially rather aggressive!

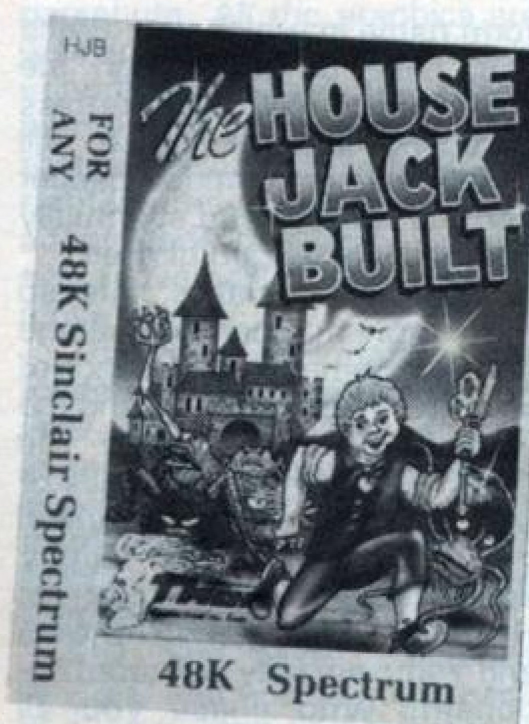




The plot is based on mythological characters and involves Morag attempting to reconstruct the all-powerful Dragontorc. Morac's almost impossible task is to prevent her from doing this and to rescue Merlyn who is being held prisoner by her. With the character interaction, locations which need mapping, puzzles to be solved and a specific task, this must be close to perfect in the implementation of adventuring in a graphic manner.

I find Maroc's tendency of bouncing off boundaries one that makes control difficult and frustrating, and the colour attributes sometimes overlap, but these are minor quibbles.

GRAPHICS	★★★★★
ADDICTIVITY	★★★★★
OVERALL	★★★★★



The House That Jack Built
Thor
£5.95

This program presents you with nineteen screens of cartoon quality scenes which you must discover and explore to find the hidden objects. Not content with having cats or dogs for pets Jack has a selection of very vicious monsters who wander around killing him on contact. The graphics are very well drawn and the animation is good. However the infamous Spectrum colour attributes problems which causes colours to overlap is rather evident, something which is almost unavoidable with the brightly coloured screens of this program.

The actual insert instructions contain an unforgivable error, the keys mentioned are ZX;/ for LRUD, in actual fact they were QWOK in my version. A joystick option was provided.

Control is good, Jack moves positively and accurately. Some of the entrances and exits need specific directions to operate, you can move freely from location to location without having to collect the object first and many of the locations are ingeniously designed.

I enjoyed the program for about an hour and then got bored, I have considered rerunning it from time to time but never got round to it. There doesn't appear to be enough variation in the action to make it really addictive. This would be an excellent game for those who enjoy the maze/chase type of programs with excellent graphics.

GRAPHICS	★★★★★
ADDICTIVITY	★★★
OVERALL	★★★



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SIGNALMAN

Duncan Munro has done a lot of research in Londonderry to ensure the accuracy of his signal box simulation

This program simulates the working of a modern signal box and is based on the actual working practice of the local Coleraine box. In order to get the details right, I spent some time with the signal man on a recent Saturday afternoon when traffic was quite busy. I had a very interesting time, away from the computer for a change, discussing and watching the actual operations and working methods.

The Coleraine Section incidentally was one of the first to be fitted with track circuiting, colour light signalling, and a route indicator board in the box in the late 1930's.

The Coleraine signal box has many interesting features, including control of two level crossing games, a lifting cantilevered rail bridge across the river Bann, and control of trains on the main Belfast-Londonderry line as well as the branch line to Portrush. There are 48 levers in the lever frame so my computer simulation is a considerable simplification with only (!) 16 levers. Nevertheless, the program does include all the essential features. These include full interlocking of the crossing gates with the signals and points levers through a king lever as in real life. The lever colour coding is also accurately represented within the limits of the Spectrum's 8 colours. It does not attempt however, to handle the various bell codes exchange between adjacent signal boxes, as this would require a program in its own right, and also slow operation down to an unacceptable level. There may seem to be a lot of beeps used but, in practice, a signal box is a surprisingly noisy place with different bells, buzzers, and telephones sounding every few minutes.

The program contains several novel features, including working in real time to a pre-set timetable. At the end of the program, the overall efficiency of the signalman is calculated and displayed. This takes into account both the efficiency in running the trains to the timetable and the delays imposed on the road traffic. This delay has been made proportional to time on an exponential, rather than linear basis, so that a balance has to be achieved, as in real life, between running the trains on time, and keeping the road open to traffic for as long as possible.

Skill is required in efficient and effective route setting and driving the trains while in the section. The program is not 'fast moving' in the arcade game sense but rather corresponds to the speed of operation required in real life practice. The degree of difficulty can be changed by small alterations in the delay function exponential power value. A value of 2, for example, instead of 1.5 will increase road delays to the point where a high score is almost impossible. A demo mode option is included, allowing the user to familiarise himself with the lever codes and the operation of the gates, signals, points, trains, etc. merely by pressing one key when instructed.

Once a train is accepted and a route set up for it, the operator changes roles to become the engine driver. After driving the train to its correct place (a stop signal, across a junction, or out of section) he reverts back to the signalman role.

The program structure and detailed instructions are described separately. However one or two items are noteworthy —

1. Due to the large number (37) of user-defined graphics, these are split into two sets and each set called up as needed by poking values into system variable 23675.
2. The program makes full use of Boolean operators (AND, NOT) to ensure correct signal interlocking with the gates, and to ensure correct subroutines are used to run the trains correctly at a points various possible scenarios, and is essential in directing the trians correctly at a points junction.

The method of directing the train at a junction, is, I believe, somewhat unique. It is fully explained in the subsequent text.

Finally, the program requires 24.1K for the Basic listing and consequently requires a 48K Spectrum.

It has been thoroughly tested and debugged. It is 'idiot proof' and wil not permit trains to be driven while the gates are closed to rail traffic, neither can a train be driven past a signal at danger. It will also stop and request an immediate 'Accident Investigation' if two trains are allowed to collide, or are driven into the buffers.

Operating instructions

You are in charge of a Signal Box. Your section is controlled by colour lights based on British Signalling Practice. Seven trains wil be offered to you in sequence of the operating time table, from 15.00 hours onwards (you will find it useful to make a note of the timetable codes for reference). No more than 2 trains in section are permitted. The branch line train is a local rail bus. After discharging passengers, the rail bus must wait for the MAIN line train, and then be rerouted back via the DOWN BRANCH line. Therefore, the rail bus must cross over to the Down Line before you can accept an UP MAIN line train. The seventh and final train is a DOWN freight train which has to be diverted to the siding, and then all signals set to 'ON' and the crossing gates closed. Your score will then be shown. BUT NO SCORE IF YOU CRASH!

The score takes into account delays in routing of trains through your section and excessive delays to road traffic due to keeping the crossing gates closed. Car drivers' aggravation is indicated on an exponentially rising decibel scale!

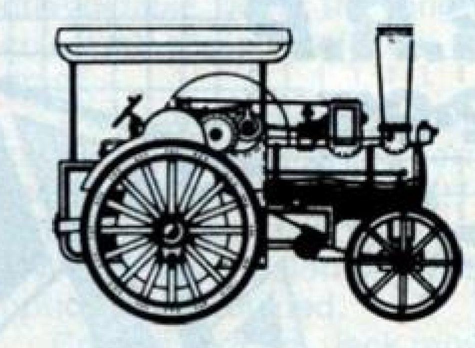
For safety reasons, the gates, and the signal levers are fully interlocked. Gates must be opened first before pulling off any other levers. The King lever interlock (labelled KL) must then be pulled off before you can pull off any signal levers. This sequence must be reversed before closing the gates (remember that closing the gates here means closing to *rail* traffic, not road traffic!).

The levers are colour coded (Yellow = distant, red = starter or home or advanced starter, black = ground signal, green = gate lever, magenta = king lever, and cyan = down line junction route indicator).

1 = 'ON' (at danger or caution)
0 = 'OFF' (clear)

So, to pull off the Down Starter, input DS0. A demo mode operation is available to assist in familiarising the lever frame operation. When you have accepted a train, and set the routine up, you change roles and become the engine driver! When you have driven the train to its correct position, i.e. up to a signal at danger, or out of section, you will return to the box automatically. Otherwise key 'S' to return to the box.

A description of the train codes and the operating timetable are shown at start of the program. The train codes are alpha numeric, containing 5 characters. The first is a numeral, 1 to 4, giving the train description, the second and third characters are alpha and indicate the line on which the train is travelling when entering section, and the last two are digits showing the time due in section. Thus, '2DMO5' signifies ordinary (stopping) passenger train due on the down main line at 1505 hours.



Lever interlocking

There are 3 types of interlocks — variables LOCK, KL and L (n) — to ensure that:

a) the signals cannot be set to clear if gates are shut (to rail traffic).

b) the gates cannot be shut if a signal is at clear

As in real life practice, it is necessary to have an intermediate lever, called a KING lever, which must be pulled off before any signal lever is pulled. It must also be set back 'ON' before the gates can be opened or closed. when the gates are opened, they are physically locked in position by latch set in the road surface. The diagram illustrates the sequence of interlocking. '1' means lever is pulled 'OFF'. '0' means lever is set 'ON'.

Program structure

Lines	
20-90	Train codes and Timetable.
100-254	Define USR graphics and store first 17 characters at addresses 65368 upwards. Store remainder at addresses 64,000 and up.
280 and 600 etc.	Poke system variable 23675 to call up required set of graphics.
295-680	Draw layout (the draw statements are left in the original format of one number minus another. I found this was essential to the task of plotting and drawing to an exact pixel position and correcting any errors).
750-790	Add ink colours.
800-805	Store lever codes and corresponding signal print coordinates for use in subsequent subroutines.
865-877	Start the clock (see the Sinclair Manual).
900-965	Main control program — controls which subroutines to call depending on whether one or two trains already in section and whether a train has been accepted into section.
1000-1090	Controls the lever frame operation and calls appropriate subroutine.
1100-1160	Finds starting coordinates of a train entering section and lights up route indicator.
1170-1360	Main routine to drive trains.
1400-1590	Accident Notices. Program stops if activated.
1600-1720	Warning Notices if incorrect lever operation attempted.
1900-1950	Calculates the time, in minutes, that the gates have been opened and increments the value to the power 1.5 to give aggravation level on an exponentially rising scale of 'decibels' (rd).
2000-2040	Exit from driving routine, and return to signal box operation.
2100-2220	Subroutines for trains 1 and 2 to determine new print positions.
3000-3070	Individual train codes.
3100-3297	Gate and King lever routines including interlock setting (see text for details). Line 3227 — ot = time gates opened Line 3295 — cumrd = cumulative road traffic delays for each interval of time gates opened and closed.
3300-4050	Operates signal levers, sets appropriate signal colour, changes the points, and sets signal interlock.
5000-5390	Evaluates the track on which each train is standing. Sets the appropriate variables pt 1, pt 2, pt 3, pt 4, for train 1 and vt 1, vt 2, vt 3, vt 4, for train 2. Returns to subroutines 2100-2220 to evaluate the correct direction to move E, W, NE, SE, SW, or NW) for in keys '5', '8', or 'Q' or 'P' (see text for details).
7000-7015	Subroutines to call up appropriate set of graphics.
8000-8060	Calculates the actual time for the digital clock display.
9000-9300	Calculates the displays final scores as separate performances against rail timetable operation and road traffic delay and also shows overall performance.
9500-9990	Demonstration mode routine.
USER GRAPHICS	Use the graphics mode key when typing the letters A, B, C, D, etc. after the PRINT AT statements in lines 300, 305, 330, 360, 390-400, 410, 414, 416, 418, 520, 522, 620-642, 675, 677, 678, 750-790, BUT *NOT* in lines 650 or 652 or 656 or 800. Use graphics key again at lines 3180, 3208, 3218, 3219, 3222, 3225, 3270, 3277, 3278, 3284, 3285, 3287, 3356, 3376. and again at lines 3910 to 3950, but *only* the letter after the PRINT statement, *not* the letter after IF u$ = "".

To open the gates:

At the start, LOCK = 0 (gate lever)
KL = 1 (King lever)
L(n) to L(14) = 1 (the signal lever locks are all set to 1).

Pull off CO Open Gates. LOCK = 1

Pull off KL KL = 0

Signal levers can now be pulled off. (L(1), etc. 0).

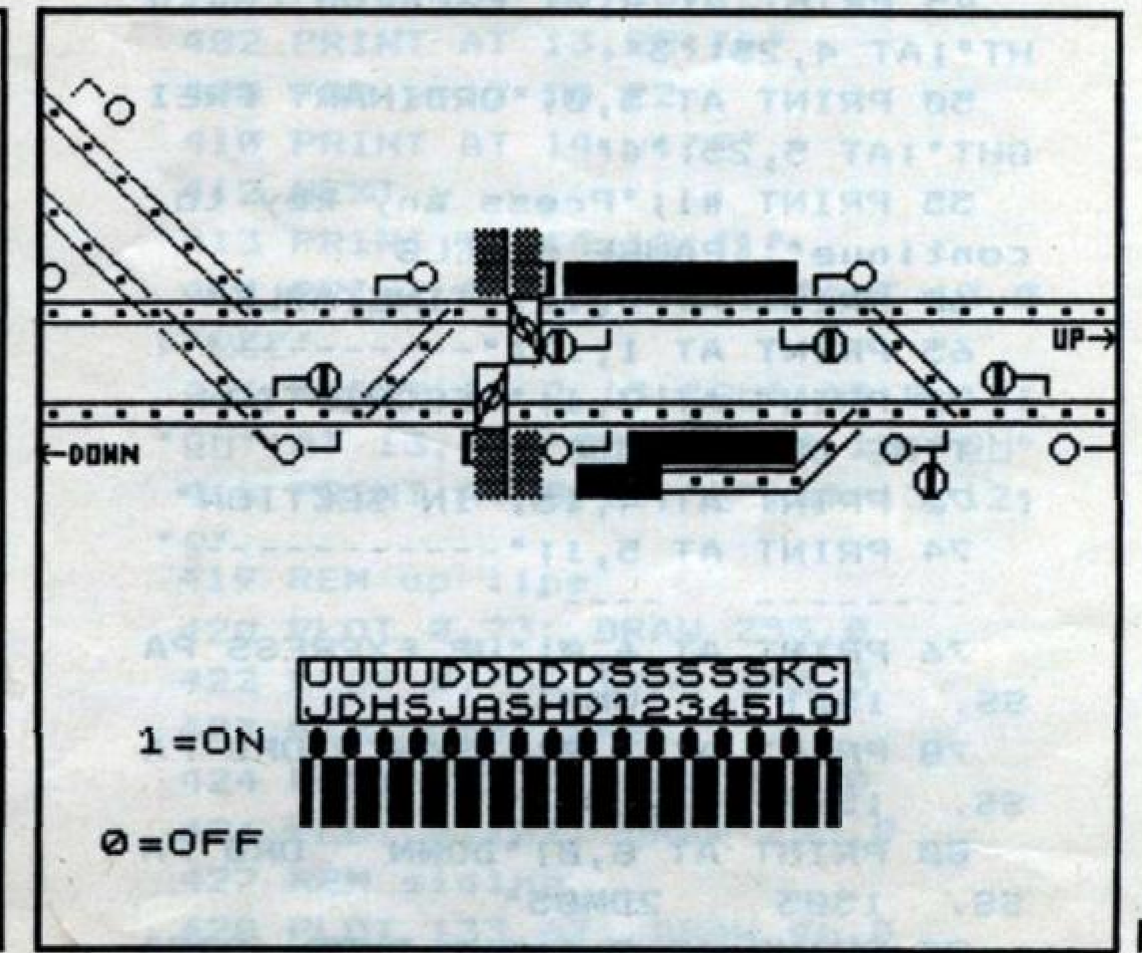
To shut the Gates:

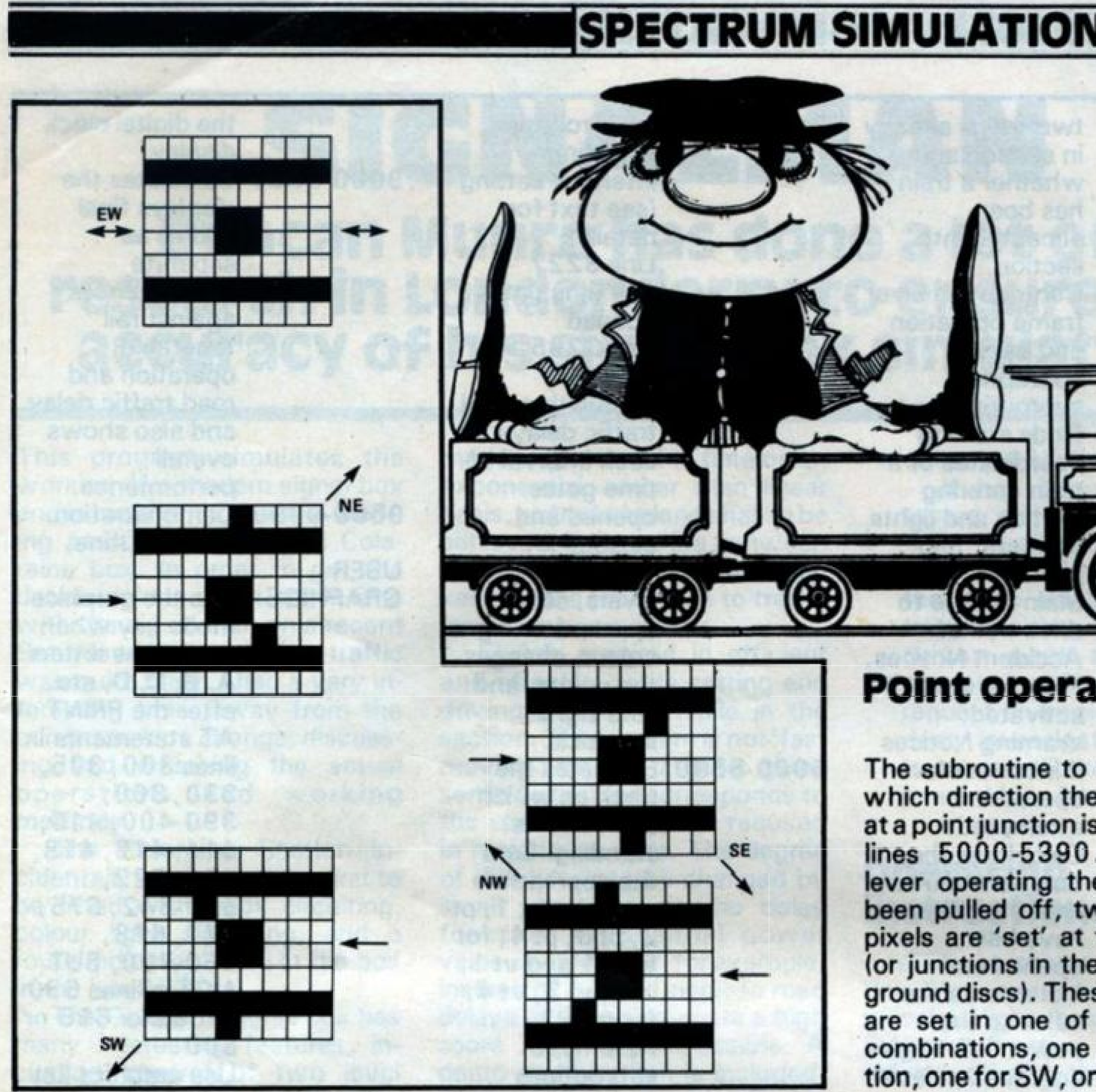
All the signal levers must be reset to ON L(n) to L(14) = 1).

Set on KL KL = 1

Set on CO Close Gates LOCK = 0

LOCK	KL	L	
0	1	1	START — GATES CLOSED
1	1	1	OPEN GATES
1	0	1	PULL KING LEVER
1	0	0	SET SIGNALS
1	0	1	RESET SIGNALS
1	1	1	RESET KING LEVER
0	1	1	CLOSE GATES





Point operation

The subroutine to determine in which direction the train travels at a point junction is contained in lines 5000-5390. When the lever operating the points has been pulled off, two additional pixels are 'set' at the junction, (or junctions in the case of the ground discs). These two pixels are set in one of four unique combinations, one for NE direction, one for SW, one for SE, and one for NW. When the point lever is not pulled off, the pixels are not set and the train direction is E-W. So, there are 5 possible configurations as shown in the diagrams.

Lines 5020-5050 and lines 5260-5290 are required to convert PRINT AT coordinates to pixel coordinates. Then the POINT value (1 if set; 0 if not set) is obtained of the pixel coordinates and recorded in variables pt 1-4 for train 1 and vt 1-4 for train 2.

```
   5 CLEAR 63999
  1Ø REM "Signalman"by D.J.Munro
  2Ø REM train codes
  25 PRINT AT Ø,3;"DESCRIPTION
      CLASS"
  3Ø PRINT AT 1,3;"-----------
      ----"
  35 PRINT AT 2,Ø;"EXPRESS PASSE
 NGER";AT 2,25;"1"
  4Ø PRINT AT 3,Ø;"ORDINARY PASS
 ENGER";AT 3,25;"2"
  45 PRINT AT 4,Ø;"EXPRESS FREIG
 HT";AT 4,25;"3"
  5Ø PRINT AT 5,Ø;"ORDINARY FREI
 GHT";AT 5,25;"4"
  55 PRINT #1;"Press any key to
 continue": PAUSE Ø: CLS
  6Ø PRINT AT Ø,12;"TIMETABLE"
  65 PRINT AT 1,12;"---------"
  7Ø PRINT AT 3,1;"DESCRIPTION
 TIME DUE    CODE"
  72 PRINT AT 4,15;"IN SECTION"
  74 PRINT AT 5,1;"-----------
 --------------"
  76 PRINT AT 6,Ø;"UP EXPRESS PA
 SS.   15Ø1     1UMØ1"
  78 PRINT AT 7,Ø;"BRANCH ORD PA
 SS.   15Ø3     2UBØ3"
  8Ø PRINT AT 8,Ø;"DOWN    ORD PA
 SS.   15Ø5     2DMØ5"
  82 PRINT AT 9,Ø;"UP EXPR. FREI
 GHT    15Ø9     3UMØ9"
  84 PRINT AT 1Ø,Ø;"BRANCH ORD P
 ASS.   1512     2UB12"
  86 PRINT AT 11,Ø;"UP     ORD P
 ASS.   1516     2UM16"
  88 PRINT AT 12,Ø;"DOWN ORD FRE
 IGHT   152Ø     4DM2Ø"
  9Ø PRINT #1;"Press any key to
 continue": PAUSE Ø: CLS
  95 INPUT "PLEASE SET CAPS MODE
 , THEN ENTER";c$
 1ØØ PRINT AT 16,8;"PLEASE WAIT!
 "
 1Ø5 RESTORE
 11Ø FOR n=1 TO 37
 115 IF n>=18 THEN  GO SUB 7Ø1Ø
 12Ø READ a$
 13Ø FOR x=Ø TO 7
 14Ø READ a
 15Ø POKE USR a$+x,a
 16Ø NEXT x
 17Ø NEXT n
 179 REM route indicator light
 18Ø DATA "a",Ø,Ø,Ø,24,24,Ø,Ø,Ø
 181 REM up arrow
 182 DATA "b",87,85,87,84,116,Ø,
 Ø,Ø
 184 DATA "c",4,2,127,2,4,Ø,Ø,Ø
 185 REM down arrow
 186 DATA "d",Ø,Ø,Ø,32,64,254,64
 ,32
```

```
 188 DATA "e",Ø,Ø,Ø,2Ø6,17Ø,17Ø,
17Ø,2Ø6
 19Ø DATA "f",Ø,Ø,Ø,169,173,239,
235,169
 191 REM road surface
 192 DATA "g",171,85,171,85,171,
85,171,85
 194 DATA "h",42,85,42,85,42,85,
42,85
 195 REM gate warning lights
 196 DATA "i",Ø,Ø,Ø,Ø,96,24Ø,24Ø
,96
 198 DATA "j",6,15,15,6,Ø,Ø,Ø,Ø
 199 REM right gate post
 2ØØ DATA "k",231,1Ø3,1Ø3,1Ø3,1Ø
3,1Ø3,1Ø3,231
 2Ø1 REM closed gates, right
 2Ø2 DATA "l",255,129,193,193,16
1,185,181,211
 2Ø3 DATA "m",2Ø3,173,157,133,13
1,131,129,255
 2Ø4 REM closed gates, left
 2Ø5 DATA "n",255,129,131,131,13
3,157,173,2Ø3
 2Ø6 DATA "o",211,181,185,161,19
3,193,129,255
 2Ø8 REM track section
 2Ø9 DATA "p",Ø,255,Ø,24,24,Ø,25
5,Ø
 21Ø REM left gate post
 211 DATA "q",7,6,6,6,6,6,6,7
 213 REM down line light arm
 214 DATA "a",Ø,56,68,13Ø,13Ø,13
Ø,68,56
 216 DATA "b",1,1,1,1,255,Ø,Ø,Ø
 217 REM up line light arm
 218 DATA "c",Ø,Ø,Ø,255,128,128,
128,128
 22Ø DATA "d",56,68,13Ø,13Ø,13Ø,
68,56,Ø
 221 REM down line colour light
 222 DATA "e",Ø,56,124,254,254,2
54,124,56
 223 REM up line colour light
 224 DATA "f",56,124,254,254,254
,124,56,Ø
 225 REM junction indicator
 226 DATA "g",24,12,6,3,1,Ø,Ø,Ø
 227 REM ground disc on
 228 DATA "h",6Ø,9Ø,153,153,153,
153,9Ø,6Ø
 229 REM ground disc off
 23Ø DATA "i",6Ø,7Ø,143,157,185,
241,98,6Ø
 231 REM ground disc arms
 232 DATA "j",128,128,128,128,25
5,Ø,Ø,Ø
 236 DATA "k",Ø,Ø,Ø,255,1,1,1,1
 237 REM junction arm
 238 DATA "l",Ø,Ø,Ø,Ø,24,36,66,1
29
 239 REM lever
 24Ø DATA "m",Ø,24,6Ø,6Ø,6Ø,6Ø,6
Ø,24
 241 REM lever frame
 242 DATA "n",231,231,231,231,23
1,231,231,231
 243 REM route indicator light
 244 DATA "o",Ø,Ø,Ø,24,24,Ø,Ø,Ø
 245 REM siding junction arm
 246 DATA "p",1,1,1,255,8,8,8
 247 REM up line open gates
 248 DATA "q",255,129,13Ø,132,13
5,142,177,255
 25Ø DATA "r",255,141,113,225,33
,65,129,255
 251 REM down line open gates
 252 DATA "s",255,177,142,135,13
2,13Ø,129,255
 254 DATA "t",255,129,65,33,225,
113,141,255
 28Ø GO SUB 7ØØØ
 295 FOR y=Ø TO 31
 3ØØ PRINT AT 9,y;"A"
 3Ø5 PRINT AT 12,y;"A"
 31Ø NEXT y
 32Ø FOR x=3 TO 8
 325 LET y=x-3
 33Ø PRINT AT x,y;"A"
 335 NEXT x
 34Ø FOR x=6 TO 12
 35Ø LET y=x-6
 36Ø PRINT AT x,y;"A"
 38Ø NEXT x
 39Ø PRINT AT 1Ø,11;"A"
 392 PRINT AT 1Ø,25;"A"
 396 PRINT AT 11,1Ø;"A"
 398 PRINT AT 11,26;"A"
 4ØØ PRINT AT 13,23;"A"
 4Ø2 PRINT AT 13,22;"█"
 4Ø5 FOR y=17 TO 22
 41Ø PRINT AT 14,y;"A"
 412 NEXT y
 413 PRINT AT 14,18;"█"
 414 PRINT AT 1Ø,3Ø;"BC";AT 13,Ø
;"DEF"
 416 PRINT AT 7,13;"GH";AT 8,13;
"GH";AT 13,13;"GH";AT 14,13;"GH"
 418 PRINT AT 8,15;"K";AT 13,12;
"Q"
 419 REM up line
 42Ø PLOT Ø,73: DRAW 255,Ø
 422 PLOT Ø,78: DRAW 255,Ø
 423 REM down line
 424 PLOT Ø,97: DRAW 255,Ø
 426 PLOT Ø,1Ø2: DRAW 255,Ø
 427 REM siding
 428 PLOT 133,62: DRAW 46,Ø
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 43Ø PLOT 133,57: DRAW 47,Ø
 431 REM up branch
 432 PLOT Ø,154: DRAW 5Ø,1Ø4-154
 434 PLOT Ø,148: DRAW 49,99-148
 435 REM down branch
 436 PLOT Ø,13Ø: DRAW 5Ø,8Ø-13Ø
 438 PLOT Ø,124: DRAW 49,75-124
 439 REM loop 1/2
 44Ø PLOT 77,8Ø: DRAW 2Ø,1ØØ-8Ø
 442 PLOT 78,75: DRAW 2Ø,95-75
 443 REM loop 3/4
 446 PLOT 198,1ØØ: DRAW 2Ø,8Ø-1Ø
Ø
 448 PLOT 197,95: DRAW 2Ø,75-95
 449 REM siding junction
 45Ø PLOT 18Ø,63: DRAW 13,76-63
 452 PLOT 181,58: DRAW 13,71-58
 455 PLOT  OVER 1;27,1Ø3
 456 PLOT  OVER 1;29,1Ø1
 457 PLOT  OVER 1;26,98
 458 PLOT  OVER 1;28,96
 46Ø FOR y=16 TO 21
 47Ø PRINT AT 8,y;"■"
 472 PRINT AT 13,y;"■"
 48Ø NEXT y
 496 PRINT AT 8,22;"▌"
 5ØØ PRINT AT 14,16;"■"
 5Ø5 PRINT AT 14,17;"■"
 51Ø PRINT AT 13,17;"▐"
 518 REM gates closed
 52Ø PRINT AT 9,14;"L";AT 1Ø,14;
"M"
 522 PRINT AT 11,13;"N";AT 12,13
;"O"
 59Ø REM *****call second set of
 graphics
 6ØØ GO SUB 7Ø1Ø
 62Ø PRINT AT 13,3Ø;"AB";AT 13,2
5;"AP";AT 13,15;"AB"
 625 PRINT AT 14,26;"H"
 63Ø PRINT AT 13,6;"GAB"
 635 PRINT AT 8,Ø;"D";AT 8,1Ø;"C
D";AT 8,23;"CD"
 64Ø PRINT AT 11,7;"CH";AT 1Ø,22
;"JH";AT 1Ø,15;"HB";AT 11,28;"HK
"
 642 PRINT AT 2,1;"L";AT 3,2;"D"
 65Ø PRINT AT 16,8;"UUUUDDDDDSSS
SSKC"
 652 PRINT AT 17,8;"JDHSJASHD123
45LO"
 656 PRINT AT 18,3;"1=ON";AT 21,
2;"Ø=OFF"
 66Ø PLOT 63,32: DRAW 193-63,Ø:
DRAW Ø,15: DRAW 63-193,Ø: DRAW Ø
,-15
 668 LET c$="26225222600ØØØ34"
 67Ø FOR y=8 TO 23
 672 LET ik=VAL c$(y-7)
 675 PRINT AT 18,y; INK ik;"M"
 677 PRINT AT 19,y; INK Ø;"N"
 678 PRINT AT 2Ø,y;"N"
 68Ø NEXT y
 7ØØ INPUT " SWITCH ON?(Y/N)";q$
 71Ø IF q$="Y" THEN  GO TO 73Ø
 712 IF q$="y" OR q$="n" THEN  G
O TO 725
 72Ø GO TO 7ØØ
 725 INPUT "PLEASE SET CAPS MODE
, THEN ENTER";c$: GO TO 7ØØ
 73Ø BEEP .2,5Ø
 75Ø PRINT AT 13,3Ø; INK 6;"E";A
T 13,25; INK 2;"E";AT 13,15; INK
 2;"E"
 76Ø PRINT AT 13,7; INK 2;"E"
 77Ø PRINT AT 8,Ø; INK 6;"F";AT
8,11; INK 2;"F";AT 8,24; INK 2;"
F"
 78Ø PRINT AT 3,2; INK 2;"E"
 79Ø PRINT AT 11,8; INK 2;"H";AT
 1Ø,15; INK 2;"H";AT 1Ø,23; INK
2;"H";AT 11,28; INK 2;"H";AT 14,
26; INK 2;"H"
 8ØØ LET s$="UJUDUHUSDJDADSDHDDS
1S2S3S4S5"
 8Ø5 LET p$="Ø3Ø2Ø8ØØØ811Ø824113Ø
613Ø7131513251330110810151Ø23112
81426"
 81Ø DIM l(14)
 815 REM set all signal locks to
 ON
 82Ø FOR n=1 TO 14
 822 LET l(n)=1
 824 NEXT n
 83Ø REM initialise variables
 835 LET ik=Ø: LET tr=1
 837 LET demo=Ø
 84Ø LET tr1=Ø: LET tr2=Ø
 845 DIM x(2): DIM y(2)
 85Ø LET ot=Ø: LET rd=Ø: LET cum
rd=Ø
 855 REM set king lever lock to
ON & gate lock to OFF.
 86Ø LET KL=1: LET LOCK=Ø
 865 REM set time to 15ØØ hrs.
 867 POKE 23674,41: POKE 23673,5
Ø: POKE 23672,224
 869 DEF FN m(x,y)=(x+y+ABS (x-y
))/2
 87Ø DEF FN u()=(65536*PEEK 2367
4+256*PEEK 23673+PEEK 23672)/(5Ø
*6Ø*6Ø)
 871 DEF FN t()=FN m(FN u(),FN u
())
 872 LET sthr=INT (FN t())
 873 LET stmin=INT ((FN t()-sthr
)*6Ø)
 875 PRINT AT 17,26;"TIME"
```

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 876 PRINT AT 18,29;"HRS"
 877 PRINT AT 18,25;sthr;AT 18,2
7;"Ø";AT 18,28;stmin: BEEP .Ø1,2
Ø
 88Ø INPUT "DEMO MODE?(Y/N)";q$
 885 IF q$="Y" THEN  GO TO 95ØØ
 89Ø GO SUB 9ØØ
 895 IF tr>=8 THEN  GO SUB 1ØØØ:
 LET cumrd=cumrd+rd: GO TO 9ØØØ
 897 GO TO 89Ø
 9ØØ REM ****** main program
 9Ø5 LET nt1=Ø: LET nt2=Ø
 91Ø IF tr1 AND tr2 THEN  GO TO
965
 92Ø GO SUB 3ØØØ+(tr*1Ø)
 93Ø INPUT "ACCEPT CODE ";(d$);"
?(Y/N)";q$
 935 IF q$="Y" AND (tr1 OR tr2)
THEN  LET tr=tr+1: GO TO 95Ø
 937 IF q$="Y" AND NOT tr1 AND N
OT tr2 THEN  LET tr1=1: LET nt1=
1: LET tr=tr+1: GO TO 956
 94Ø IF q$<>"Y" AND q$<>"N" THEN
  GO TO 93Ø
 945 IF q$="N" THEN  GO TO 96Ø
 95Ø IF tr1 THEN  LET tr2=1: LET
 nt2=1: GO TO 956
 954 LET tr1=1: LET nt1=1
 956 PRINT AT Ø,3;"TRAIN ";d$;"
accepted"
 958 GO SUB 11ØØ: GO SUB 1ØØØ: G
O SUB 117Ø: RETURN
 96Ø IF NOT tr1 AND NOT tr2 THEN
  GO SUB 1ØØØ: RETURN
 965 GO SUB 1ØØØ: GO SUB 117Ø: R
ETURN
1ØØØ REM lever frame operation
1ØØ5 GO SUB 18ØØ
1Ø1Ø IF LOCK THEN  GO SUB 19ØØ
1Ø12 IF NOT LOCK THEN  PRINT AT
6,6;"                  "
1Ø15 INPUT "ENTER LEVER CODE";r$
1Ø2Ø IF LEN r$<>3 AND r$<>"RS" T
HEN  GO TO 1Ø15
1Ø25 IF r$="RS" THEN  RETURN
1Ø3Ø IF r$(1 TO 3)="COØ" THEN  G
O SUB 32ØØ: GO TO 1Ø1Ø
1Ø32 IF r$(1 TO 3)="KLØ" THEN  G
O SUB 31ØØ: GO TO 1Ø1Ø
1Ø34 IF r$(1 TO 3)="CO1" THEN  G
O SUB 325Ø: GO TO 1Ø1Ø
1Ø36 IF r$(1 TO 3)="KL1" THEN  G
O SUB 315Ø: GO TO 1Ø1Ø
1Ø38 IF r$(3)<>"Ø" AND r$(3)<>"1
" THEN  GO TO 1Ø1Ø
1Ø39 IF r$(1)<>"U" AND r$(1)<>"D
" AND r$(1)<>"S" THEN  GO TO 1Ø1
Ø
1Ø4Ø REM first check interlocks
set for signal operation
1Ø45 IF KL OR NOT LOCK THEN  GO
SUB 16ØØ: GO SUB 18ØØ: GO TO 1Ø1
5
1Ø5Ø REM ***find lever & signal
colour and print position
1Ø8Ø GO SUB 33ØØ
1Ø9Ø GO TO 1Ø1Ø
11ØØ REM find entry point
11Ø5 IF d$(2 TO 3)="UB" AND nt1
THEN  LET x(1)=3: LET y(1)=Ø
111Ø IF d$(2 TO 3)="UB" AND nt2
THEN  LET x(2)=3: LET y(2)=Ø
1115 IF d$(2 TO 3)="UM" AND nt1
THEN  LET x(1)=9: LET y(1)=Ø
112Ø IF d$(2 TO 3)="UM" AND nt2
THEN  LET x(2)=9: LET y(2)=Ø
1125 IF d$(2 TO 3)="DM" AND nt1
THEN  LET x(1)=12: LET y(1)=31
113Ø IF d$(2 TO 3)="DM" AND nt2
THEN  LET x(2)=12: LET y(2)=31
114Ø REM show train position
1145 IF nt1 THEN  PRINT  BRIGHT
1; OVER 1;AT x(1),y(1);"Q"
1155 IF nt2 THEN  PRINT  BRIGHT
1; OVER 1;AT x(2),y(2);"Q"
116Ø RETURN
117Ø REM *** drive train ***
1174 PRINT AT Ø,3;"   OPERATE TR
AIN CONTROLS       "
1175 PRINT AT 1,3;"SHORT FLASH:
key '5' or '8'    "
1176 PRINT AT 2,3;"LONG  FLASH:
key 'Q' or 'P'    "
1177 PRINT AT 3,3;"     Key 'S' t
o call box         "
1178 PRINT AT 4,3;"
                  "
118Ø REM ******tr1-short flash;
tr2-long flash
1182 IF tr2 THEN  PRINT  BRIGHT
Ø; OVER 1;AT x(2),y(2);"Q": PAUS
E 15
1183 IF tr2 THEN  PRINT  BRIGHT
1; OVER 1;AT x(2),y(2);"Q": PAUS
E 15
1184 IF tr1 THEN  PRINT  BRIGHT
Ø; OVER 1;AT x(1),y(1);"Q"
1185 IF tr1 THEN  PRINT  BRIGHT
1; OVER 1;AT x(1),y(1);"Q"
1186 IF INKEY$="" THEN  GO TO 11
82
119Ø IF tr1 THEN  PRINT  BRIGHT
Ø; OVER 1;AT x(1),y(1);"Q"
1191 IF tr2 THEN  PRINT  BRIGHT
Ø; OVER 1;AT x(2),y(2);"Q": PAUS
E 15
1192 IF INKEY$="S" THEN  GO TO 2
ØØØ
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1193 IF tr1 THEN  GO SUB 5ØØØ
1194 IF tr2 THEN  GO SUB 52ØØ
1195 IF NOT tr1 THEN  LET pt1=Ø:
 LET pt2=Ø: LET pt3=Ø: LET pt4=Ø
1196 IF NOT tr2 THEN  LET vt1=Ø:
 LET vt2=Ø: LET vt3=Ø: LET vt4=Ø
12ØØ REM ****check for signal at
 danger
12Ø2 IF INKEY$="8" AND x(1)<1Ø A
ND ATTR (x(1)-1,y(1)+1)=58 THEN
 GO TO 2ØØØ
12Ø4 IF INKEY$="5" AND x(1)>1Ø A
ND ATTR (x(1)+1,y(1)-1)=58 THEN
 GO TO 2ØØØ
12Ø6 IF INKEY$="P" AND x(2)<1Ø A
ND ATTR (x(2)-1,y(2)+1)=58 THEN
 GO TO 2ØØØ
12Ø8 IF INKEY$="Q" AND x(2)>1Ø A
ND ATTR (x(2)+1,y(2)-1)=58 THEN
 GO TO 2ØØØ
121Ø IF INKEY$="5" OR INKEY$="8"
 THEN  GO SUB 21ØØ
122Ø IF INKEY$="Q" OR INKEY$="P"
 THEN  GO SUB 22ØØ
123Ø REM ****check if train hit
buffers
1235 IF (y(1)<=17 AND x(1)=14 AN
D tr1) OR (y(2)<=17 AND x(2)=14
AND tr2) THEN  GO TO 15ØØ
124Ø REM check for train out of
section
1244 IF (y(1)<Ø OR y(1)>31) AND
tr1 THEN  LET tr1=Ø: GO TO 2ØØØ
1245 IF (y(2)<Ø OR y(2)>31) AND
tr2 THEN  LET tr2=Ø: GO TO 2ØØØ
129Ø REM *****check trains not
collided

1295 IF x(1)=x(2) AND y(1)=y(2)
THEN  GO TO 14ØØ
135Ø REM If all O.K.,repeat for
next inkey entry
1355 IF tr1 THEN  PRINT  BRIGHT
1; OVER 1;AT x(1),y(1);"Q"
1356 IF tr2 THEN  PRINT  BRIGHT
1; OVER 1;AT x(2),y(2);"Q"
1358 BEEP .1,4Ø
136Ø GO TO 119Ø
14ØØ REM trains collided
142Ø PRINT AT Ø,Ø; FLASH 1; BRIG
HT 1; INK 2;" YOU CRASHED INTO O
THER TRAIN!"
144Ø PRINT AT 1,Ø; FLASH 1; BRIG
HT 1; INK 2;"CONDUCT ACCIDENT IN
VESTIGATION!"
146Ø GO TO 155Ø
15ØØ REM hit siding buffers
152Ø PRINT AT Ø,Ø; FLASH 1; BRIG
HT 1; INK 2;" YOU CRASHED INTO T
HE BUFFERS! "
154Ø PRINT AT 1,Ø; FLASH 1; BRIG
HT 1; INK 2;"CONDUCT ACCIDENT IN
VESTIGATION!"
155Ø PRINT AT 2,2; INK 2;"    KE
Y 'R' TO TRY AGAIN       "
156Ø PRINT AT 3,2; INK 2;"
KEY 'E' TO END           "
1565 FOR n=15 TO 1Ø STEP -1: BEE
P 1Ø/n,n: NEXT n
157Ø IF INKEY$="R" THEN  RUN
158Ø IF INKEY$="E" THEN  STOP
159Ø GO TO 157Ø
16ØØ REM warning routine -
attempting interlock override
161Ø FOR n=1 TO 1Ø
162Ø BEEP .1,5Ø
163Ø NEXT n
164Ø PRINT AT 1,3; FLASH 1; INK
2;"   GATES MUST BE OPERATED!
"
165Ø PRINT AT 2,3; INK 2;"   KIN
G LEVER MUST BE 'ON'    "
166Ø PRINT AT 3,3; INK 2;"   ALL
 SIGNALS MUST BE 'ON'   "
167Ø PRINT AT 4,3; INK 2;"PULL S
IGNAL IF KING LEVER OFF"
168Ø PAUSE 1ØØ
17ØØ LET o$="
        "
171Ø PRINT  OVER 1;AT Ø,3;o$;AT
1,3;o$;AT 2,3;o$;AT 3,3;o$;AT 4,
3;o$
172Ø RETURN
18ØØ REM  lever frame header
181Ø LET o$="
        "
182Ø PRINT AT 1,3;"   OPERATE LE
VER FRAME        "
183Ø PRINT AT 2,3;"    Key 'RS' w
hen route set.   "
184Ø PRINT AT 3,3;o$;AT 4,3;o$
185Ø RETURN
19ØØ REM road traffic delay
191Ø LET rd=INT ((((FN t())*6Ø*
6Ø)-ot)/6)^1.5)
192Ø PRINT AT 6,6;"Aggro=";rd;AT
 6,16;"decibels"
195Ø RETURN
2ØØØ REM ****return to operate
signals
2ØØ2 IF demo AND LOCK THEN  GO S
UB 19ØØ: GO TO 2Ø2Ø
2ØØ3 IF demo AND NOT LOCK THEN
GO TO 2Ø2Ø
2ØØ5 LET o$="
        "
2ØØ6 IF NOT LOCK THEN  PRINT AT
1,3;o$: GO TO 2Ø15
```

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2007 GO SUB 1900
2010 PRINT AT 1,3; FLASH 1;"
  REM:ROAD TRAFFIC!    "
2015 PRINT AT 0,3;o$;AT 2,3;o$;A
T 3,3;o$;AT 4,3;o$
2020 BEEP 1,45: BEEP 1,45
2030 IF tr1 THEN  PRINT  BRIGHT
1; OVER 1;AT x(1),y(1);"O"
2035 IF tr2 THEN  PRINT  BRIGHT
1; OVER 1;AT x(2),y(2);"O"
2040 RETURN
2100 LET y(1)=y(1)+(INKEY$="8")-
(INKEY$="5")
2110 LET x(1)=x(1)+(INKEY$="8" A
ND pt3)-(INKEY$="8" AND pt1)+(IN
KEY$="5" AND pt2)-(INKEY$="5" AN
D pt4)
2120 RETURN
2200 LET y(2)=y(2)+(INKEY$="P")-
(INKEY$="Q")
2210 LET x(2)=x(2)+(INKEY$="P" A
ND vt3)-(INKEY$="P" AND vt1)+(IN
KEY$="Q" AND vt2)-(INKEY$="Q" AN
D vt4)
2220 RETURN
3000 REM *******train codes for
scheduled arrival times:
1501,1503,1505,1509 hours.,etc.
3010 LET d$="1UM01": RETURN
3020 LET d$="2UB03": RETURN
3030 LET d$="2DM05": RETURN
3040 LET d$="3UM09": RETURN
3050 LET d$="2UB12": RETURN
3060 LET d$="2UM16": RETURN
3070 LET d$="4DM20": RETURN
3100 REM  open gates-pull off
king lever
3105 IF LOCK=0 THEN  GO SUB 1600
: GO SUB 1800: RETURN
3120 PRINT AT 18,22;" "
3130 PRINT AT 21,22; INK 3;"M"
3135 LET KL=0
3140 BEEP .1,45: RETURN
3150 REM   close gates-return
king lever
3151 REM first check all signals
 set to danger
3152 FOR n=1 TO 14
3153 IF l(n)=0 THEN  GO SUB 1600
: GO SUB 1800: RETURN
3154 NEXT n
3170 PRINT AT 21,22; INK 3;" "
3180 PRINT AT 18,22; INK 3;"M"
3185 LET KL=1
3190 BEEP .1,45: RETURN
3200 REM open gates
3201 REM check if KL set to ON.
3205 IF KL=0 THEN  GO SUB 1600:
GO SUB 1800: RETURN
3207 PRINT AT 18,23;" "
3208 PRINT AT 21,23; INK 4;"M"
3210 GO SUB 7000
3216 FOR n=1 TO 5
3218 PRINT AT 7,15; INK 2;"I";AT
 14,12; INK 2;"J": BEEP .3,30
3219 PRINT AT 7,15; INK 7;"I";AT
 14,12; INK 7;"J": BEEP .3,30
3220 NEXT n
3221 PAUSE 20
3222 PRINT AT 9,14;"P";AT 12,13;
"P"
3223 PRINT AT 10,14;" ";AT 11,13
;" "
3224 GO SUB 7010
3225 PRINT AT 8,13;"QR";AT 13,13
;"ST"
3227 LET ot=(FN t())*60*60
3230 REM set gate lock to ON
3235 LET LOCK=1
3245 BEEP .3,30: BEEP .3,30: RET
URN
3250 REM close gates
3255 REM check if KL set to ON
3260 IF KL=0 THEN  GO SUB 1600:
GO SUB 1800: RETURN
3265 PRINT AT 21,23;" "
3270 PRINT AT 18,23; INK 4;"M"
3273 GO SUB 7000
3276 FOR n=1 TO 5
3277 PRINT AT 7,15; INK 2;"I";AT
 14,12; INK 2;"J": BEEP .3,30
3278 PRINT AT 7,15; INK 7;"I";AT
 14,12; INK 7;"J": BEEP .3,30
3279 NEXT n
3280 PAUSE 20
3284 PRINT AT 8,13;"GH";AT 13,13
;"GH"
3285 PRINT AT 9,14;"L";AT 10,14;
"M"
3287 PRINT AT 11,13;"N";AT 12,13
;"O"
3290 LET LOCK=0
3292 BEEP .3,30: BEEP .3,30
3293 GO SUB 7010
3295 LET cumrd=cumrd+rd
3296 LET rd=0
3297 RETURN
3300 REM lever colour
3305 LET ik=2
3310 IF r$(1)="S" THEN  LET ik=0
3312 IF r$(2)="D" THEN  LET ik=6
3314 IF r$(1)="K" THEN  LET ik=3
3316 IF r$(1 TO 2)="CO" THEN  LE
T ik=4
3318 IF r$(1)="D" AND r$(2)="J"
THEN  LET ik=5
3319 LET x=0
3320 FOR p=1 TO 27 STEP 2
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3325 IF s$(p TO p+1)=r$(1 TO 2) THEN LET x=7+((p+1)/2)
333Ø NEXT p
334Ø REM abort if no match
3345 IF x=Ø THEN RETURN
335Ø REM lever to 'on'
3355 IF r$(3)="1" THEN PRINT AT 21,x;" "
3356 IF r$(3)="1" THEN PRINT AT 18,x; INK ik;"M"
337Ø REM lever to 'off'
3375 IF r$(3)="Ø" THEN PRINT AT 18,x;" "
3376 IF r$(3)="Ø" THEN PRINT AT 21,x; INK ik;"M"
35ØØ REM signal colour
351Ø IF r$(1 TO 2)<>"DJ" AND r$(2)<>"D" AND r$(3)="1" THEN LET ik=2
3515 IF r$(1 TO 2)<>"DJ" AND r$(1)<>"S" AND r$(2)<>"D" AND r$(3)="Ø" THEN LET ik=4
3517 IF r$(1)="S" AND r$(3)="Ø" THEN LET ik=2
352Ø IF r$(1 TO 2)="DJ" AND r$(3)="1" THEN LET ik=Ø
353Ø IF r$(1 TO 2)="DJ" AND r$(3)="Ø" THEN LET ik=5
3535 IF r$(2)="D" AND r$(3)="1" THEN LET ik=6
354Ø IF r$(2)="D" AND r$(3)="Ø" THEN LET ik=4
36ØØ REM now find position
361Ø LET n=1: LET z=Ø
362Ø FOR p=1 TO 27 STEP 2
363Ø IF s$(p TO p+1)=r$(1 TO 2) THEN LET x=VAL p$(n TO n+1): LET y=VAL p$(n+2 TO n+3): LET z=p: LET p=27: GO TO 365Ø
364Ø LET n=n+4
365Ø NEXT p
377Ø REM  now find correct user graphic
378Ø IF x=3 OR x=8 THEN LET u$="F"
3782 IF x=13 AND y<>6 THEN LET u$="E"
3785 IF (x=1Ø OR x=11 OR x=14) AND r$(3)="Ø" THEN LET u$="I"
379Ø IF (x=1Ø OR x=11 OR x=14) AND r$(3)="1" THEN LET u$="H"
3795 IF x=13 AND y=6 THEN LET u$="G"
38ØØ REM set signal interlock
381Ø IF r$(3)="1" THEN LET l((z+1)/2)=1
382Ø IF r$(3)="Ø" THEN LET l((z+1)/2)=Ø
39ØØ REM now alter signal
391Ø IF u$="E" THEN PRINT INK ik;AT x,y;"E": BEEP .4,25
392Ø IF u$="F" THEN PRINT INK ik;AT x,y;"F": BEEP .4,25
393Ø IF u$="I" THEN PRINT INK ik;AT x,y;"I": BEEP .4,1Ø
394Ø IF u$="H" THEN PRINT INK ik;AT x,y;"H": BEEP .4,1Ø
395Ø IF u$="G" THEN PRINT INK ik;AT x,y;"G": BEEP .4,25
396Ø REM now alter points
397Ø IF r$(3)="Ø" THEN LET a=Ø
3972 IF r$(3)="1" THEN LET a=1
3975 LET a$=r$(1 TO 2)
398Ø IF a$="UJ" THEN PLOT OVER a;5Ø,98: PLOT OVER a;51,1Ø3
399Ø IF a$="DJ" THEN PLOT OVER a;27,1Ø3: PLOT OVER a;29,1Ø1: PLOT OVER a;26,98: PLOT OVER a;28,96: PLOT OVER a;5Ø,74: PLOT OVER a;51,79
4ØØØ IF a$="S1" OR a$="S2" THEN PLOT OVER a;76,79: PLOT OVER a;77,74: PLOT OVER a;99,96: PLOT OVER a;98,1Ø1
4Ø1Ø IF a$="S3" OR a$="S4" THEN PLOT OVER a;196,96: PLOT OVER a;197,1Ø1: PLOT OVER a;218,74: PLOT OVER a;219,79
4Ø2Ø IF a$="S5" THEN PLOT OVER a;194,77: PLOT OVER a;195,72
4Ø5Ø RETURN
5ØØØ REM calculate pixel coords. of train tr1
5Ø2Ø LET q1=175-(x(1)*8)
5Ø3Ø LET q2=168-(x(1)*8)
5Ø4Ø LET p1=4+(y(1)*8)
5Ø5Ø LET p2=3+(y(1)*8)
51ØØ REM now record if pixel set
511Ø LET pt1=POINT (p1,q1)
512Ø LET pt2=POINT (p2,q2)
513Ø LET pt3=POINT (p1,q2)
514Ø LET pt4=POINT (p2,q1)
519Ø RETURN
52ØØ REM calculate pixel coords. of train tr2
526Ø LET w1=175-(x(2)*8)
527Ø LET w2=168-(x(2)*8)
528Ø LET v1=4+(y(2)*8)
529Ø LET v2=3+(y(2)*8)
53ØØ REM now record if pixel set
535Ø LET vt1=POINT (v1,w1)
536Ø LET vt2=POINT (v2,w2)
537Ø LET vt3=POINT (v1,w2)
538Ø LET vt4=POINT (v2,w1)
539Ø RETURN
7ØØØ REM first user graphic set
7ØØ5 POKE 23675,88: POKE 23676,255: RETURN
```

```
7010 REM second user graphic set
7015 POKE 23675,0: POKE 23676,25
0: RETURN
8000 REM calculate the time
8010 LET hr=INT (FN t())
8020 LET min=INT ((FN t()-hr)*60
)
8030 IF min<10 THEN  PRINT AT 18
,25;hr;AT 18,27;"0";AT 18,28;min
: BEEP .01,20
8040 IF min>=10 THEN  PRINT AT 1
8,25;hr;AT 18,27;min: BEEP .01,2
0
8060 RETURN
9000 REM *****calculate overall
performance
9010 CLS
9020 GO SUB 8000
9040 IF min<=20 THEN  PRINT AT 0
,0;"GOOD RUNNING TO TIMETABLE":
LET score=100: GO TO 9070
9050 IF min>=40 THEN  PRINT AT 0
,0;"OVER-RAN TIMETABLE BY >20min
s.": LET score=0: GO TO 9070
9060 LET score=INT (200-(5*min))
9070 PRINT AT 1,0;"TRAIN RUNNING
=";score;"%"
9100 LET norm=140
9110 IF cumrd<=norm THEN  PRINT
AT 3,0;"NORMAL ROAD DELAY": LET
aggro=100: GO TO 9150
9120 LET aggro=INT ((140/cumrd)*
100)
9150 PRINT AT 4,0;"ROAD TRAFFIC=
";aggro;"%"
9160 LET total=INT (aggro+score)
/2
9180 PRINT AT 6,0;"OVERALL RATIN
G=";total;"%"
9200 PRINT AT 18,11;"PROGRAM END
ED:";AT 18,29;"hrs"
9300 STOP
9500 REM demo mode
9501 LET demo=1
9502 PRINT AT 1,6; INK 2;"DEMO M
ODE"
9503 PRINT AT 2,3;"PRESS 'ENTER'
 KEY          "
9504 PRINT AT 3,3;"WATCH CODE AN
D SCREEN"
9505 DIM h$(20)
9506 LET o$="
          "
9507 REM *****accept UP EXPRESS
PASSENGER,"1UM01"
9510 LET h$="C00KL0US0UH0UD0"
9515 LET m=13: LET nt1=1: LET nt
2=0: LET tr1=1: LET tr=1
9517 GO SUB 3000+(tr*10)
9520 INPUT "ACCEPT CODE ";(d$);"
?(Y/N) Y";f$
9523 GO SUB 1100
9524 GO SUB 9900
9525 PRINT AT 4,3; FLASH 1;"Key
'8'-drive out of section"
9526 GO SUB 1180
9527 REM **train out of section
9528 REM **close gates
9530 PRINT AT 4,3;o$
9533 LET h$="UD1UH1US1KL1C01"
9535 GO SUB 9900
9537 REM accept UP BRANCH ORDINA
RY PASSENGER,"2UB03"
9540 LET h$="C00KL0UH0UJ0"
9542 LET m=10: LET nt1=1: LET tr
1=1: LET tr=2
9545 GO SUB 3000+(tr*10)
9546 INPUT "ACCEPT CODE ";(d$);"
?(Y/N) Y";f$
9548 GO SUB 1100: GO SUB 9900
9550 PRINT AT 4,3; FLASH 1;"Key
'8'-drive to UP starter"
9551 GO SUB 1180
9552 REM **train in section
9553 REM **close gates
9554 PRINT AT 4,3;o$
9556 LET h$="UJ1UH1KL1C01"
9558 GO SUB 9900
9560 REM **accept DOWN ORDINARY
PASSENGER,"2DM05"
9564 LET h$="C00KL0DH0"
9565 LET m=7: LET nt1=0: LET nt2
=1: LET tr2=1: LET tr=3
9567 GO SUB 3000+(tr*10)
9568 INPUT "ACCEPT CODE ";(d$);"
?(Y/N) Y";f$
9570 GO SUB 1100: GO SUB 9900
9573 PRINT AT 4,3; FLASH 1;"Key
'Q'-drive to DOWN starter"
9575 GO SUB 1180
9580 REM **train in section
9581 REM **close gates
9582 PRINT AT 4,3;o$
9585 LET h$="DH1KL1C01"
9587 GO SUB 9900
9589 REM **train in section
9590 REM **  open gates
9591 REM ** set route for DOWN
MAIN PASSENGER
9593 LET h$="C00KL0DA0DS0"
9595 LET m=10
9597 GO SUB 9900
9600 PRINT AT 4,3; FLASH 1;"Key
'Q'-drive out of section"
9602 GO SUB 1180
9603 LET nt1=0: LET nt2=0: LET t
r2=0
9605 REM ** train in section
```

```
9606 REM ** reset for UP BRANCH
PASSENGER
9608 PRINT AT 4,3;o$
9610 LET h$="DS1DA1S30US0"
9615 GO SUB 9900
9617 PRINT AT 4,3; FLASH 1;"Key'
8'-run to down line-Key S"
9618 PRINT AT 5,4; INK 2; FLASH
1;"Do NOT drive out of section"
9620 GO SUB 1180
9622 IF tr1=0 THEN  CLS : GO TO
9655
9625 REM ** train in section
9626 REM ** reset for DOWN line
9628 PRINT AT 4,3;o$;AT 5,3;o$
9630 LET h$="US1S31DA0DJ0DS0DH0"
9632 LET m=16
9633 GO SUB 9900
9635 PRINT AT 4,3; FLASH 1;"Key
'5'-drive out of section"
9638 GO SUB 1180
9640 REM **trains out of section
9641 REM **close gates
9645 PRINT AT 4,3;o$
9647 LET h$="DH1DS1DJ1DA1KL1CO1"
9650 GO SUB 9900
9655 PRINT AT 1,6; FLASH 1; INK
2;"END OF DEMO "
9657 BEEP .5,50
9660 PRINT AT 2,0; FLASH 1;"Key
'S' for performance rating "
9662 PRINT AT 3,0; FLASH 1;"of f
irst 3 trains of timetable."
9665 IF INKEY$="S" THEN  GO TO 9
000
9667 GO TO 9657
9900 REM find lever code
9910 FOR e=1 TO m STEP 3
9920 LET r$=h$(e TO e+2)
9925 INPUT "ENTER LEVER CODE ";(
r$);f$
9930 IF r$="CO0" THEN  GO SUB 32
00: GO TO 9972
9940 IF r$="KL0" THEN  GO SUB 31
00: GO TO 9972
9950 IF r$="CO1" THEN  GO SUB 32
50: GO TO 9972
9960 IF r$="KL1" THEN  GO SUB 31
50: GO TO 9972
9970 GO SUB 3300
9972 IF LOCK THEN  GO SUB 1900
9973 IF NOT LOCK THEN  PRINT AT
6,6;"          "
9975 NEXT e
9980 LET r$="RS"
9985 INPUT "ENTER LEVER CODE ";(
r$);f$
9990 RETURN
```

Tortoise Wise

More lines from a parent who gets left behind.

Some houses don't have chimneys anymore. Ours does. Chimneys can catch fire. Ours did. Last week.

"Don't panic," I screamed, as somewhere up in the soot an inferno raged. And no one else in the house did. I know that because as I 'phoned for the Fire Brigade I could not help but be impressed by the way my two sons calmly and quietly made their way past me to go upstairs.

In fact I did not see them again for the next half hour.

"Goodnight and Thank you," said the Fire Chief when it was all over. "I should get the boys in now. It's all safe, and it must be pretty cold out there". Boys? Out? Where?

I started after the happy fireman into the night. Then I saw them. My two sons, the two hares, standing together in the front garden, their faces drawn with anxiety. The eldest was clutching the Spectrum under one arm, his cassette recorder under the other and he had a tangle of leads around his neck. His younger brother stood guard over the portable T.V., a box of tapes and a bundle of magazines.

"We saved all the valuables" they announced as I approached. "Is it safe to take them all back in now?"

I didn't sleep too well that night.

One afternoon, a week earlier, our humdrum existence had been livened up by some bright spark a few doors away who had inadvertently done something shocking to the electricity cable supplying our houses. We were without electricity for most of that evening. This old Tortoise handled the powerless hours in style. An old oil lamp, coffee on the camping stove, and a good book.

The hares went frantic. The Spectrum sat silent and still in front of the dark screen. They rattled its keys in vain. They sweated by candlelight. They paced around in the dark fidgetting and groaning. Waiting for their lifeline to be reconnected.

"This is Boring" they moaned with the regularity of the pips on a digital watch. "What can we do?"

"This has been the worst night of our lives", they wailed as they went to bed in Computerless Darkness. Can it be so easy to throw them off their stride, I wondered? That night I slept quite well, Tortoise wise.

Then there was the invitation to visit some people who had fled the noisy city to savour the tranquil delights of the country. We decided to go down and see them for a day.

"What will we do all day?" asked number two son from the back seat of the car.

"Play on their Spectrum of course" said his brother. "I remembered to bring some games. Did you?"

"Hold on a moment" I put in. "What makes you two think they will have a micro? Never mind a Spectrum. Not everyone has a computer in their home you know." Their jaws drop open and they turn a little pale. They inch closer to each other on the seat.

"They don't ??????" they gasp.

"They might not even have electricity," "I told them.

"Oh no," they croaked in horror. "Not again."

"It's a hard life," I joked.

"It's the end of the world," they squawked. I chuckled quietly to myself and thought, "this balances things up somewhat. One up for the Tortoise in the great Race. It doesn't bother me." And for a while I did not feel as if I was quite so far behind.

De-bugger

Getting a program typed in is often only the start of your problems. Ed to the rescue.

Typing in a program is a useful exercise. Apart from the patience required, techniques learned and the end program to be used, probably the most educational part of it is tracking down the bugs introduced by yourself or occasionally by our publication system.

In debugging you gain a much deeper insight and understanding on how the program actually works than by merely typing it in, but tracking down these errors is an art in itself and needs some skill. So here are some tips to help you in your efforts when faced with that cryptic error report!



1 NEXT without FOR
Look back through the program, either the loop has not been set up — no related FOR 'letter' = No1 TO No2 line, or the letter has been re-used as an ordinary variable within the loop with a LET 'letter' = No.

2 Variable not found
This is one of the most common errors. Again, the problem may not lie in the line where the error was detected and reported. If there is only one variable, which may be one or more letters or a string ($) variable, then that is the problem. There may be more than one variable in the line section reported and you will have to identify the offending one. In a line PRINT AT Y,X;A$ the culprit could be Y or X or A$. To find out which of them is causing the problem (it may be more than one) type in turn as a direct command:

PRINT Y Enter/Newline
PRINT X Enter/Newline
PRINT A$ Enter/Newline

Note which produces the error report. Now look back through the program printout for the line which sets it up — usually a LET or FOR command. Did you leave it out? Does the program get there or has a GOTO/GOSUB been wrongly addressed?

3 Subscript wrong
Connected with DIM A(No) or DIM A$(No). If the number in the brackets on the line where the error is reported is greater than the one in the original DIM statement, is not an integer or is less than 1, then this report is generated. If the subscript — number in brackets — is a number then check and change, however, if it is a variable then follow the procedure for tracing variables. It has probably exceeded the limits, look for lines with the variable being altered with + − * / : if necessary add limiting code. For example:

IF X >10 THEN LET X = 10

4 Out of memory
As well as for programs which are too big, it may happen if the previous program set RAMtop. Before despairing, enter CLEAR USR "a"-1 on the Spectrum: on the ZX81 SAVE the program, turn the machine off and on, then reload the program.

7 RETURN without GOSUB
Somehow the computer has reached a RETURN command other than via a GOSUB instruction. Check a GOTO hasn't been entered in place of a GOSUB. Check for a missing GOSUB.

B Integer out of range
An integer (whole number) either as a number of variable is too big or small and you are attempting to do something like PRINT AT 0,33 — not allowed! Check any variables involved as per report 2 and trace it back through the program looking for adjustments to it by + − * / : Add limiting code if needed — see report 3

E Out of DATA
A Spectrum problem. Check the number of DATA items match the number of READs; usually one (or more) has been missed out. Attempting to reread a DATA list without first using a RESTORE command will cause this and it can happen on an auto start program (saved with a LINE number). Good programming usually RESTOREs to the correct line number before using READ.

I FOR without NEXT
See report 1 but this time the NEXT is missing!

Note that the letters I have used for examples could by ANY letters not just A$,X,Y etc and depend on the particular choice of the programmer.

This is by no means a comprehensive list but I have tried to cover many of the most common error reports. Personally, I get almost as much satisfaction from debugging as I do from programming I do assure you, however, that there is absolutely no truth in the rumour that we deliberately inject bugs into our listings in order to introduce you to the dubious delights of debugging!

Basic Hybrid Stack Queue

Advanced techniques discussed and presented by Frazer Melton of Lincolnshire.

STACKS & QUEUES — IN THEORY

A computer stack stores variables in the same way as a stack in "the real world". For example, if you put a £1 coin on a table, and on top of that a 1p, and on tope of the 1p a 50p you will have made a stack of coins.

The first coin onto the stack — the £1 — is on the bottom of the stack. The last — the 50p — is on the top. In computer terms you have PUSHed the coins onto the stack. When it comes to taking the coins off the stack you are forced to do so in reverse order: first the 50p, then the 1p, and finally the £1. The last item onto the stack — in this case the 50p — is always the first off. Because of this, stacks are called LIFO structures (LIFO = "Last In: First Out").

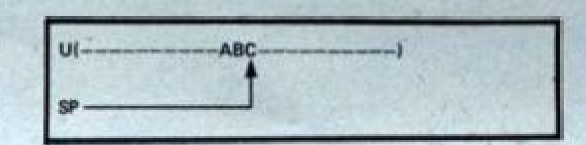
In computer terms you have POPped the coins off the stack. Queues, in contrast to stacks, are FIFO structures (FIFO = "First In: First Out"). This means that the order of items onto a queue in the same as the order off.

Imagine a queue of people of a supermarket checkout. The person at the front of the queue (ie the first person to join the queue) will be the first to be served and the first to leave the queue. The person at the rear of the queue will have to wait for all those ahead to be served before he/she is served. The same terms (PUSH & POP) are used for movements of items onto (PUSH) and off (POP) a queue.

STACKS & QUEUES — IN PRACTICE

Both stacks and queues require an area of memory to be reserved for their use. In the stack/-queue program listed below numerical array U() is set aside for this purpose. The maximum size of U() is set to the value of LIMIT (Lines 9116 & 9117).

A variable called the Stack Pointer — SP — holds the location of the last item pushed onto the stack. Assuming the stack consists of variables A, B, and C — C being the most recent entry — the stack will look like this:

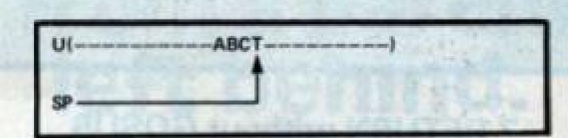


The line connecting SP to variable C indicates that the contents of SP are to be treated as the address of the top stack element in array U(). B is stored in U(SP-1). A is stored in U(SP-2).

The sequence of operations for a PUSH is as follows:

```
LET SP=SP+1
LET U(SP)=T
```

— leaving the stack like this:

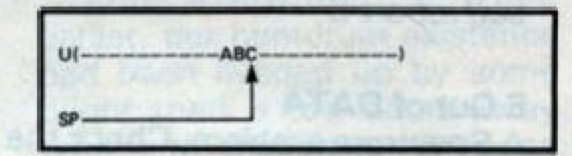


It is necessary to add one to the stack pointer before the data is written onto the stack because the stack pointer always points to the topmost item on the stack. The next free space is always at U(SP+1)

POP works on similar lines to PUSH, but here the data transfer is from the stack to the temporary variable T:

```
LET T=U(SP)
LET SP=SP-1
```

which, by reversing the PUSH sequence, returns the stack to its original form:



Pushes and pops to and from a stack must be *nested*. This means that, in the previous example, A could not be popped off the stack until T, C and B had been popped off. An example of correct nesting is: PUSH A, PUSH B, PUSH C, POP C, POP B, POP A. An example of *incorrect* nesting: PUSH A, PUSH B, POP A, POP B. (This fails because the value returned by POP A will be the value pushed on by PUSH B). Stack operations can be complex:

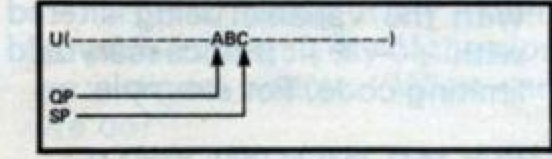
PUSH A, PUSH B, PUSH C, POP C, PUSH D, PUSH E, POP E, POP D, POP B, POP A

but they must always be correctly nested.

Queues need 2 pointers: one to tell the computer where to write data in, and another to tell it where to read data out. In the programs below QP (Queue pointer) is the data-out pointer, and SP (Stack pointer) the data-in pointer. SP is common to the queue and stack to allow easy transfer of data between them, and to keep demands on computer memory to a minimum.

One consequence of having a common data entry point (through the stack pointer) is that a PUSH to the queue is identical to a PUSH to the stack. A POP from the queue, however, is opposite in effect to a stack POP: ie it pops off the first variable to be pushed onto the stack/queue.

Assuming, once more, that variables A, B, and C have been PUSHed onto the stack (and queue), array U() will look like this:

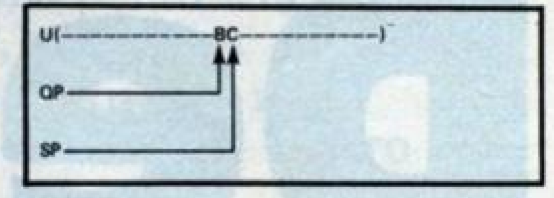


SP points to the items most recently PUSHed onto the stack/queue; QP to the first item PUSHed onto the stack/queue.

A POP from the queue does this:

```
LET T=U(QP)
LET QP=QP+1
```

leaving the stack/queue like this:



As you can see, both QP and SP move one place to the right (+1) for each item on the queue. To stop the queue running over the end of available memory, array U() is treated as a circular list or racetrack. This means that if at any time QP or SP exceed the upper limit of U() they will automatically have their values changed to 1 to point at the left-most (lowest subscript) element in array U. (Lines 9003 & 9023).

Strings can also be PUSHED and POPPED; but, because they cannot be stored in a numerical array, the actual string of characters is dumped in string array U$. Pointers to the first and last character are PUSHed onto the stack/queue.

The operations involved are complex but can be summarised:

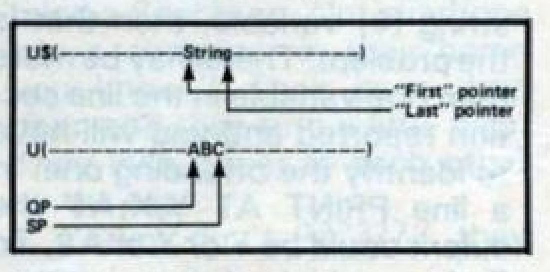
PUSH String:
1) Write string into U$
2) PUSH pointer to first character onto stack/Queue
3) PUSH pointer to last character onto stack/queue

POP String (Off stack):
1) POP Pointer to last character. (off stack)
2) POP Pointer to first character (off stack)
3) Read string from U$

POP String (Off queue):
1) POP pointer to first character (off queue)
2) POP pointer to last character (off queue)
3) Read string from U$

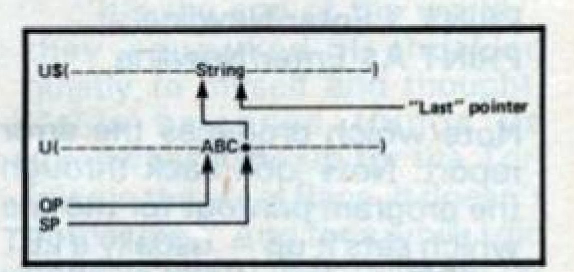
In diagramatic form PUSH String might look like:

1) Write string into U$

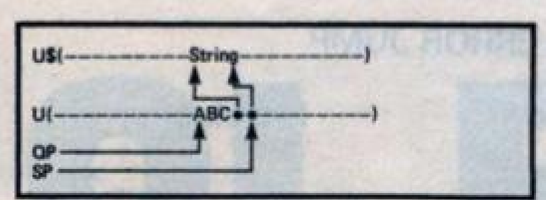


(A, B, and C are on the stack/-queue before PUSH string)

2) PUSH pointer to first character onto stack/queue

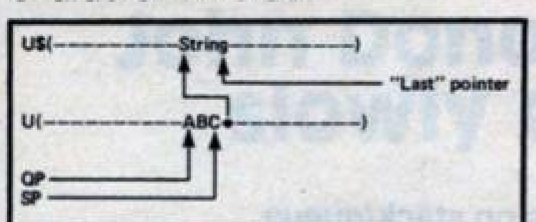


3) PUSH pointer to last character onto stack/queue

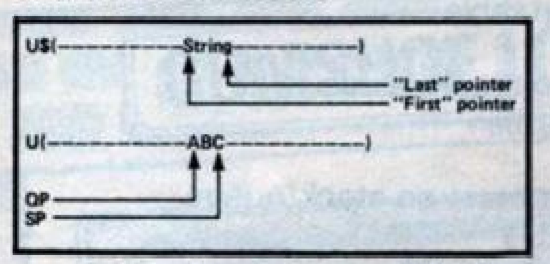


POP (stack) string does the reverse:

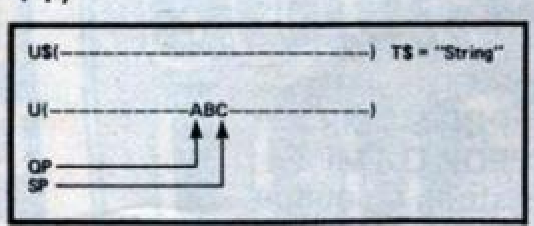
1) POP pointer to last character off stack



2) POP pointer to first character off stack



3) Read string from U$ (into T$)



USING THE SUBROUTINES

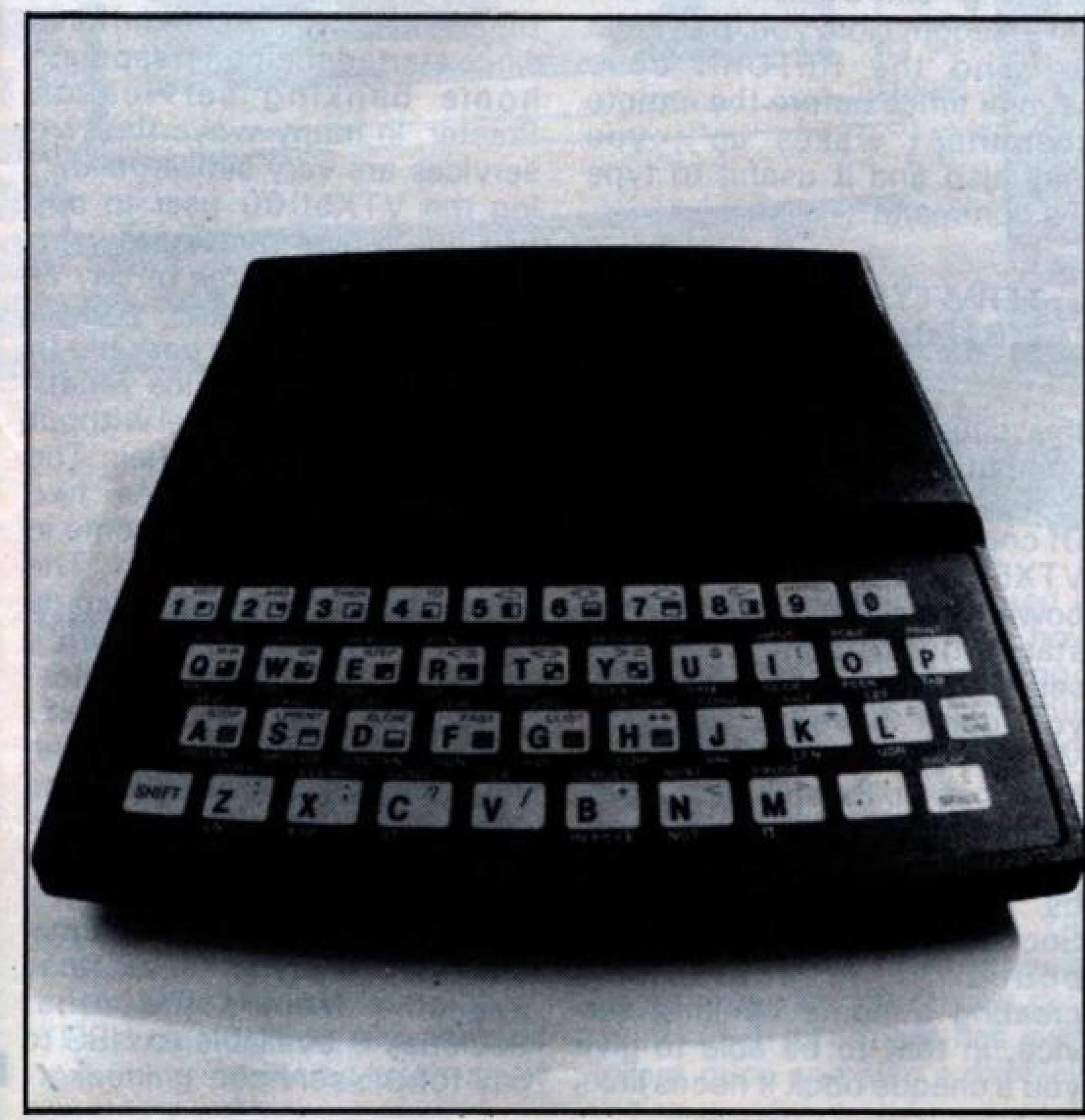
All data movements between the stack/queue and your program are through the temporary variables TMP and T$:

PUSH var to Stack/Queue:
LET TMP = var
GOSUB PUSH TMP
POP var from Stack:
GOSUB POP S TMP
LET var = TMP
POP var from Queue:
GOSUB POP Q TMP
LET var = TMP
PUSH string$ to Stack/-Queue
LET T$ = string$
GOSUB PUSH STRING
POP string$ from Stack:
GOSUB POP S STRING
LET strings$ = T$
POP string$ from Queue:
GOSUB POP Q STRING
LET string$ = T$

Lines 9001, 9002, 9011, 9012, 9021, 9022, 9031, 9032, 9057, 9058, 9067, 9068, 9071, 9076, 9087, 9090-7 detect error conditions (ie trying to POP a non-existent item or PUSHing too many items for array U to contain). If you can be certain that no such error conditions will occur they can be omitted.

Lines 9092 to 9097 form a "Jump Table". Whenever an error is detected the program jumps to one of these lines. In turn, they send the program to an error correcting subroutine. One possibility for such a subroutine is to have an alternate memory area for the stack/-queue. The exact details are left to the stack/queue user.

Before the stack/queue is used it must be initialised. GOSUB 9070 at the start of your program will do this. Lines 9080 and 9084 dictate the size of the memory area for the stack/-queue. You can put your own values in here (LET LIMIT = 50 and DIM U$(200) are a useful size for a small program).





Stack and queue subroutines

```
9000 REM + + + + PUSH TMP + + + +
9001 LET COUNT = COUNT + 1
9002 IF COUNT>LIMIT THEN GOSUB STACK ERROR
9003 LET SP = SP + 1
9004 IF SP>LIMIT THEN LET SP = 1
9005 LET U(SP) = TMP
9006 RETURN

9010 REM + + + + POPSTMP + + + +
9011 LET COUNT = COUNT - 1
9012 IF COUNT<0 THEN GOSUB STACK ERROR + 1
9013 LET TMP = U(SP)
9014 LET SP = SP - 1
9015 IF SP<1 THEN LET SP = LIMIT
9016 RETURN

9020 REM + + + + POP Q TMP + + + +
9021 LET COUNT = COUNT - 1
9022 IF COUNT<0 THEN GOSUB STACK ERROR + 2
9023 LET TMP = U(QP)
9024 LET QP = QP + 1
9025 IF QP>LIMIT THEN LET QP = 1
9026 RETURN
```

Stack and queue (string) subroutines

```
9030 REM + + + + PUSH STRING + + + +
9031 LET OCCUPIED = OCCUPIED + LEN T$
9032 IF OCCUPIED>LEN U$ THEN GOSUB STACK
     ERROR + 3
9033 LET SEP = SFP + LEN T$ - 1
9034 IF SEP>LEN U$ THEN GOTO 9043
9035 LET U$ (SFP TO SEP) = T$
9036 LET TMP = SFP
9037 GOSUB PUSH TMP
9038 LET TMP = SEP
9039 GOSUB PUSH TMP
9040 IF SEP = LEN U$ THEN LET SEP = 0
9041 LET SFP = SEP + 1
9042 RETURN
9043 LET CUT = LEN U$ -SFP + 1
9044 LET SEP = SEP-LEN U$
9045 LET U$ (SFP TO  ) = T$(  TO CUT)
9046 LET U$ (  TO SEP) = T$ (CUT + 1 TO  )
9047 GOTO 9036
9050 REM + + + + POP S STRING + + + +
9051 GOSUB POP S TMP
9052 LET SEP = TMP
9053 GOSUB POP S TMP
9054 LET SFP = TMP
9055 LET T$ = U$ (SFP TO SEP)
9056 IF SEP<SFP-1 THEN LET T$ = U$ (SFP
     TO  ) + U$ (  TO SEP)
9057 LET OCCUPIED = OCCUPIED-LENS T$
9058 IF OCCUPIED < 0 THEN GOSUB STACK
     ERROR + 4
9059 RETURN
```

▶

```
9060    REM + + + + POP Q STRING + + + +
9061    GOSUB POP Q TMP
9062    LET QFP=TMP
9063    GOSUB POP Q TMP
9064    LET SEP=TMP
9065    LET T$ =U$ (QFP TO SEP)
9066    IF SEP<QFP-1 THEN LET T$ =U$ (QFP
        TO  )+U$(  TO SEP)
9067    LET OCCUPIED=OCCUPIED-LENS T$
9068    IF OCCUPIED<0 THEN GOSUB STACK
        ERROR+5
9069    RETURN
```

Stack and queue initialisation routine

```
  9070    REM INITIAL + + + + + +
  9071    LET OCCUPIED=0
  9072    LET PUSH TMP=9000
  9073    LET POP S TMP=9010
  9074    LET POP Q TMP=9020
  9075    LET PUSH STRING=9030
  9076    LET COUNT=0
  9077    LET POP S STRING=9050
  9078    LET POP Q STRING=9060
? 9080    LET LIMIT=???
  9081    DIM U(LIMIT)
  9082    LET SFP=1
? 9084    DIM U$(???)
  9085    LET SP=0
  9086    LET QP=1
  9087    LET STACK ERROR=9092
  9088    RETURN
```

```
  9090    REM + + + +ERROR JUMP
          TABLE + + + +
? 9092    GOTO ????          (Stack error+)
? 9093    GOTO ????                    (+1)
? 9094    GOTO ????                    (+2)
? 9095    GOTO ????                    (+3)
? 9096    GOTO ????                    (+4)
? 9097    GOTO ????                    (+5)
```

LINES USED: 9000 to 9099

Variables used

COUNT	Number of items on stack/queue
LIMIT	Number of memory locations for stack/-queue
STACK ERROR	First line of jump table
SP	Stack pointer
U()	Array containing stack/queue
TMP	Temporary variable
QP	Queue pointer
OCCUPIED	Number of characters on stack/queue
SEP	End of string in U$
SFP	First free character in U$
U$()	String array dump for stack/queue
T$	Temporary variable
PUSH TMP	First line of Sub "PUSH TMP"
CUT	Temporary variable
POP S TMP	First line of Sub "POP S TMP"
POP Q TMP	First line of Sub "POP Q TMP"
QFP	First character of string on queue
PUSH STRING	First line of Sub "PUSH STRING"
POP S STRING	First line of Sub "POP S STRING"
POP Q STRING	First line of Sub "POP Q STRING"

Micronet

Since Prism (the distributors of the VTX5000 modem adaptor for the Spectrum) ceased trading, it has been possible to buy a VTX5000 for discount prices as low as £50. This opens up a whole new world of microcomputer communications for even more Spectrum users. You don't have to call Prestel/Micronet with the VTX5000, it is possible to call a variety of other services which use the 1200/75 baud asynchronous transmission protocol, such as the British Telecom PSS or Telecom Gold services, or a vast array of private viewdata systems and bulletin boards.

Quite a few of these systems require the user to key ENTER (also known as RETURN) at the end of every input line. Normally the VTX5000 converts ENTER to the hash code that Prestel requires at the end of some commands and input message lines. To change your VTX5000 to work with these systems, press BREAK while looking at one of the menus and type in the following line of BASIC:

```
800 INPUT t$ :LET
t$ =t$ +CHR$ 13:GO SUB
tx:GO TO 2000
```

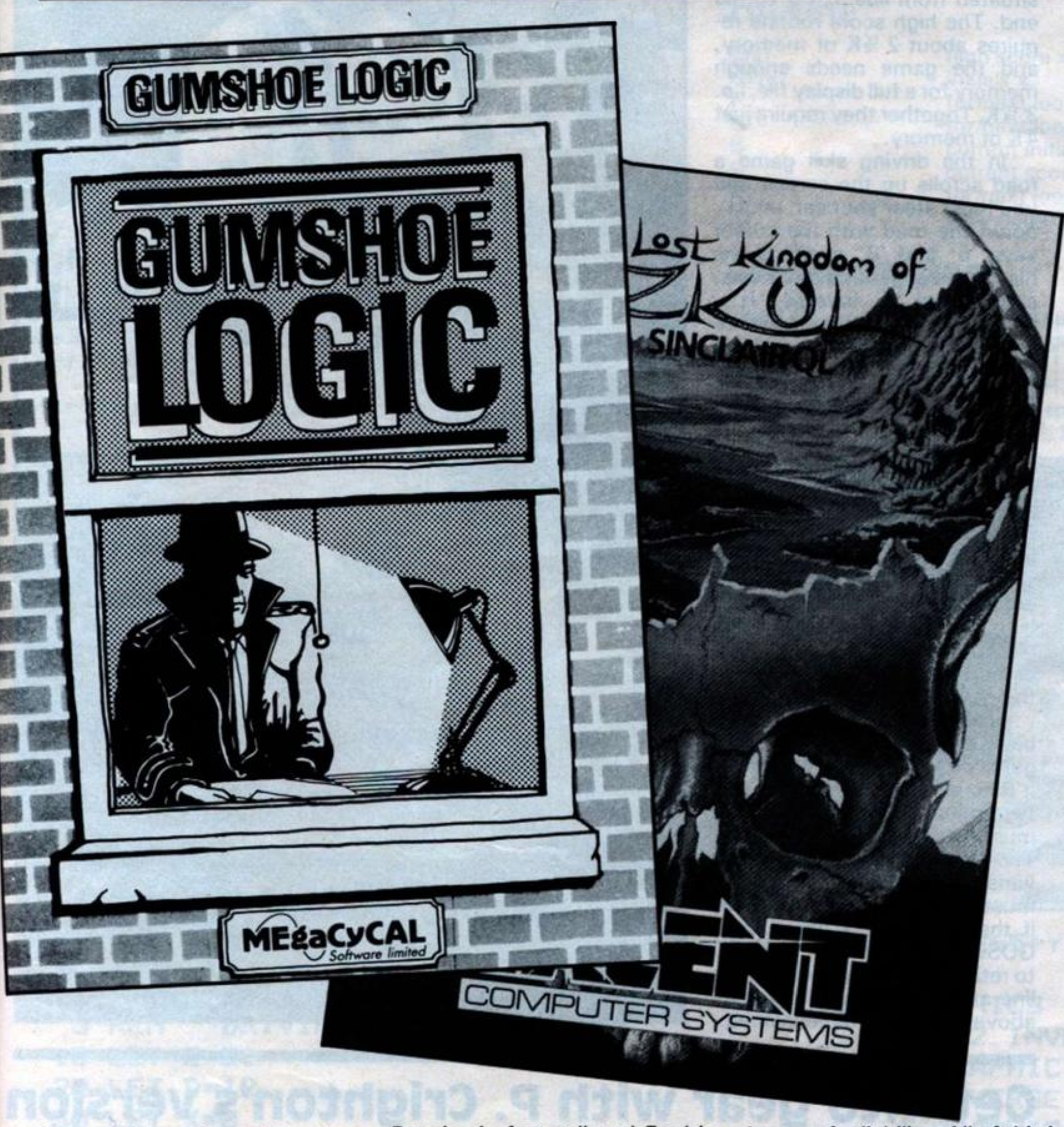
If you RUN this version of the program it will wait for a line of input. While it is waiting you can telephone the computer you want to use, when that answers with a whistle, switch the line switch from its upper to its lower position and replace the telephone handset. Most services require an initial RETURN code, so press ENTER. When you want to send more characters to the remote computer hold down CAPS SHIFT and press ENTER and the input line quotation marks will reappear. Unfortunately, the VTX5000 cannot receive characters from the remote computer while waiting for you to type in the line, so do not delay to long before pressing ENTER again. Normally you should wait until the remote computer has paused before pressing CAPS SHIFT/ENTER. On Telecom Gold you may need to send the RETURN code several times before the remote computer "wakes up", you may also find it useful to type the command:

TERM TYPE PRESTEL WRAPS

this causes the Telecom Gold computer to pause at the end of every screenful of information. Of course, if you have one of the VTX5000s with a Homelink power on screen rather than the standard Micronet power on screen you already know that you don't have to use your VTX5000 exclusively for Micronet or Prestel Microcomputing. Homelink is a home banking service on Prestel run by the Nottingham Building Society. A Building Society is bound to have problems creating a home banking service, in that to be able to give you a cheque book it needs links with a clearing bank. Nottingham Building Society overcame their clearing problems through an association with the Bank of Scotland. To confuse the issue, Bank of Scotland have since started their own separate home banking service on Prestel. In many ways the two services are very similar, allowing the VTX5000 user to pay bills and move money between accounts at any time of day or night. In conjunction with a credit card it is thus possible to order and pay for a wide variety of items through Prestel without ever leaving your armchair. The differences between the two home banking services come in the way they are funded. The Bank of Scotland service is openly funded by service charges, whereas the Nottingham Building Society Homelink service depends on you investing several thousand pounds, for which you receive normal interest — but as this money is effectively tied up, the difference between the normal rate and the high premium rates available from some other Societies is available to NBS to pay for the service. ■

QL Reviews

John Donovan looks at some of the slowly emerging QL software.



Gumshoe Logic

This is not an adventure game but, a logical reasoning game.

You play the part of a Gumshoe detective in the 1930s, time of Gangsters and molls. Depending upon which difficulty level you select the game sets you an assignment for which you will be paid on completion. The problems take the form of reasoning problems such as 'if Bert is six foot tall and Fred is one foot shorter than Bert how tall is the Empire State building?' The problems are usually slightly easier than this except on level five.

The first assignment is to find out what rackets each gang boss is involved in and also the name of his Moll (girlfriend). The information is obtained by use of informants who all require payment. Each informant has a different price and also a different degree of reliability. All of this is told to you so the game becomes a process of receiving information, sorting it and then buying more as cheaply as is possible. Once you have collected all the information and have satisfied yourself as to its reliability you may present your findings to your client who will either pay you or tell you that you are wrong. If you have been sucessful you will then receive another, harder assignment.

Gumshoe is well presented with little pictures of each of your informants on selection of the appropriate menu. On the whole, Gumshoe is rather good but should not be confused with an adventure game, which it is not.

Megacycal Software, PO Box 6, Birkenhead, Merseyside.

The Lost Kingdom of Zkul

Zkul (pronounced 'skull') is a standard middle earth adventure scenario, with the usual dwarves, a wizard and a domed city. The adventure starts near a river and you have instructions from your friend Eldomir to bring any treasures to his house in the forest.

The game combines the two main types of adventure game, the old style Hack & Slay, which had fighting and loads of monsters, and the more modern puzzle type, giving a strange hybrid. Thus, such commands as Health and a Hit point system are included giving a status for each character in the game that is reduced by fighting and increased by time. As well as this the game contains a number of very advanced puzzles which compare with any classic adventure.

The game vocabulary is very comprehensive allowing such structures as 'What is XXX' and also giving hints as to what it understands by its responses. Another novel addition is the hint facility that has the program butting into the game if you get stuck anywhere and offering a hint in return for a reduction in your score, this offer does not have to be accepted but the hints received are usually very useful. Like the Hobbit, action in the game is in real time, however unlike the Hobbit the real time routine is run under interrupts so you can be typing a command in and the computer will interrupt you to tell you that something has happened, this can be very annoying, but does promote prompt responses.

The game is supplied on microdrive which has the ability to back itself up for security, and this allows Zkul to be loaded very quickly. Saves and Restores are also done to microdrive, with a notepad facility. On the whole I was rather disapointed by Zkul which had great promise but didn't really live up to expectations.

Talent Computer Systems, Curran Building, 101 St James Rd, Glasgow.

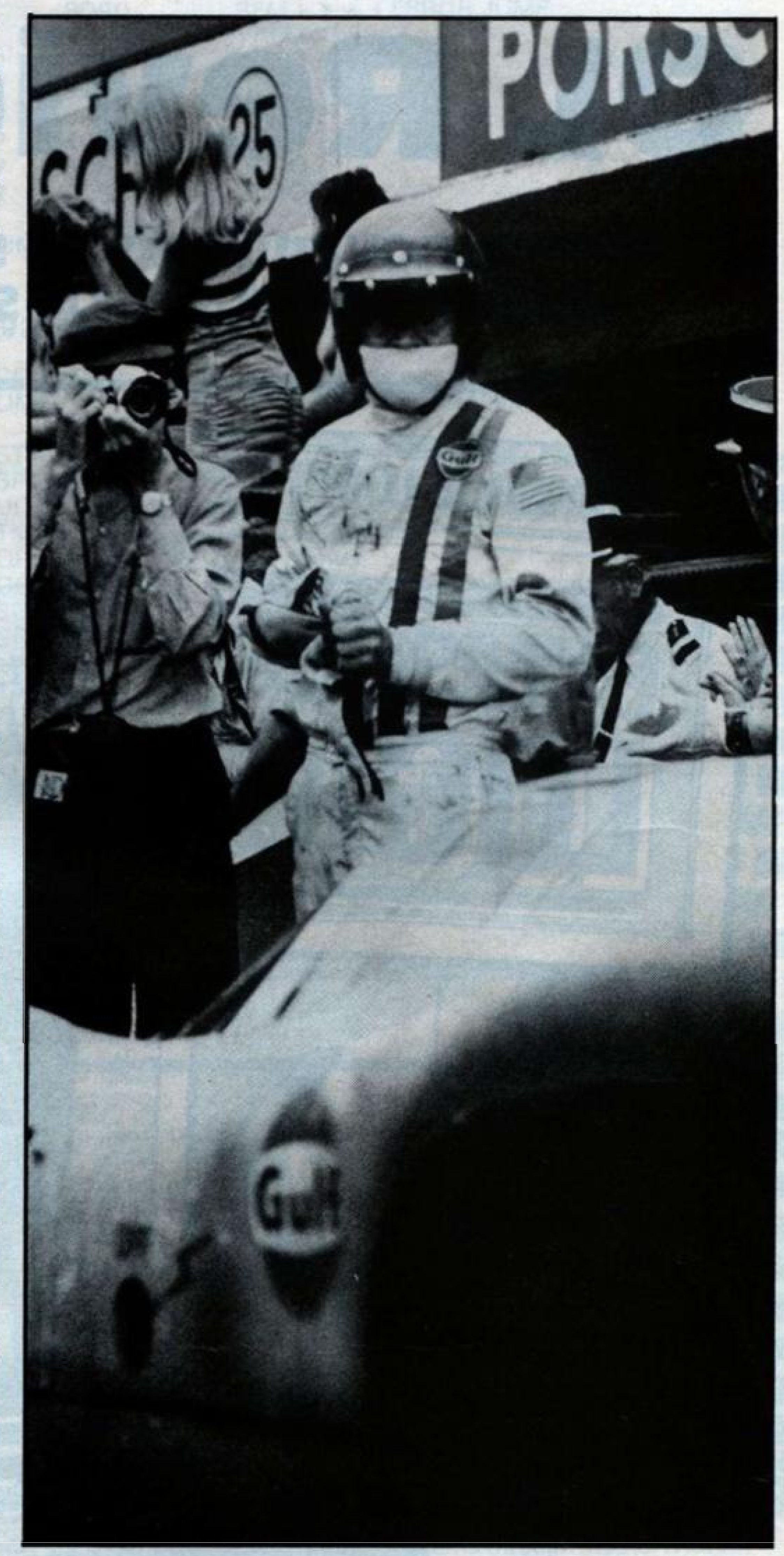


Apart from the enjoyment of this game in itself, there is an interesting High-Score routine which can be easily adapted to work within your own programs.

This is really two programs that have been combined to produce one program. The first two lines dimension the arrays required by the high score routine. *then there is the game itself, bet*ween lines 10 and 200, and finally a high score routine situated from line 9000 to the end. The high score routine requires about 2 ½K of memory, and the game needs enough memory for a full display file, i.e. 3 ¼K. Together they require just 4K of memory.

In the driving skill game a road scrolls up the screen and you must steer your car, an 'H', down the road with the cursor keys '5' and '8' avoiding the black road edges and other cars, symbolised by inverse 'H's, which increase as your score increases. Your car leaves a trail of tyre marks behind as it travels. When you crash your score is displayed at the bottom of the road and the program executes the high score routine. If your score was lower than the fifth high score then the routine informs you and prints the five highest scores. If you gain a high score then you are asked to enter your initials and again the high scores are printed. When printing the high scores, if two or more scores are identical then they are given equal placings.

The high score routine could be used with almost any other game provided that the program it is to be used with obeys certain rules. First, the program must not use the arrays B or B$. The score must be held in the variable S, and lastly line 9230 must contain either a RETURN, if the routine was called by a GOSUB instruction, or a GOTO to return it to the game, but at a line after the arrays mentioned above have been dimensioned.



Get into gear with P. Crighton's version of this ever popular game, driven all the way from Gravesend

Detailed notes about the program

Lines 2 & 3	dimension the arrays required by the high score routine.
Lines 10-60	set up the variables used by the driving skill game.
Lines 70-90	alter the position of the road.
Line 120	peeks the display file at the next position of the car.
Line 130	increases the score.
Line 140	prints the road and your car.
Line 150	prints the inverse H's to represent the other cars.
Line 160	jumps back to line 60 if you have not crashed.
Lines 170-190	flash your car when you crash.
Line 200	prints your score at the bottom of the road.
Lines 9000 & 9010	form a pause loop at the beginning of the high score routine.
Line 9030	checks if your score is lower than the fifth high score.
Lines 9040-9070	move the high scores down one place until it reaches the point where your score is to be placed and then jumps to line 9180.
Line 9180	enters the subroutine to get initials.
Lines 9190-9200	enter your score as a high score.
Lines 9210-9310	print the high scores.
Line 9320	jumps back to the game.
Lines 9400-9470	form a subroutine to save the program and high scores on tape.
Lines 9500-9530	subroutine to print lower score than the fifth high score.
Lines 9600-9740	is a subroutine to print equal placings.
Lines 9800-9830	subroutine to obtain initials.

Variables used for the game

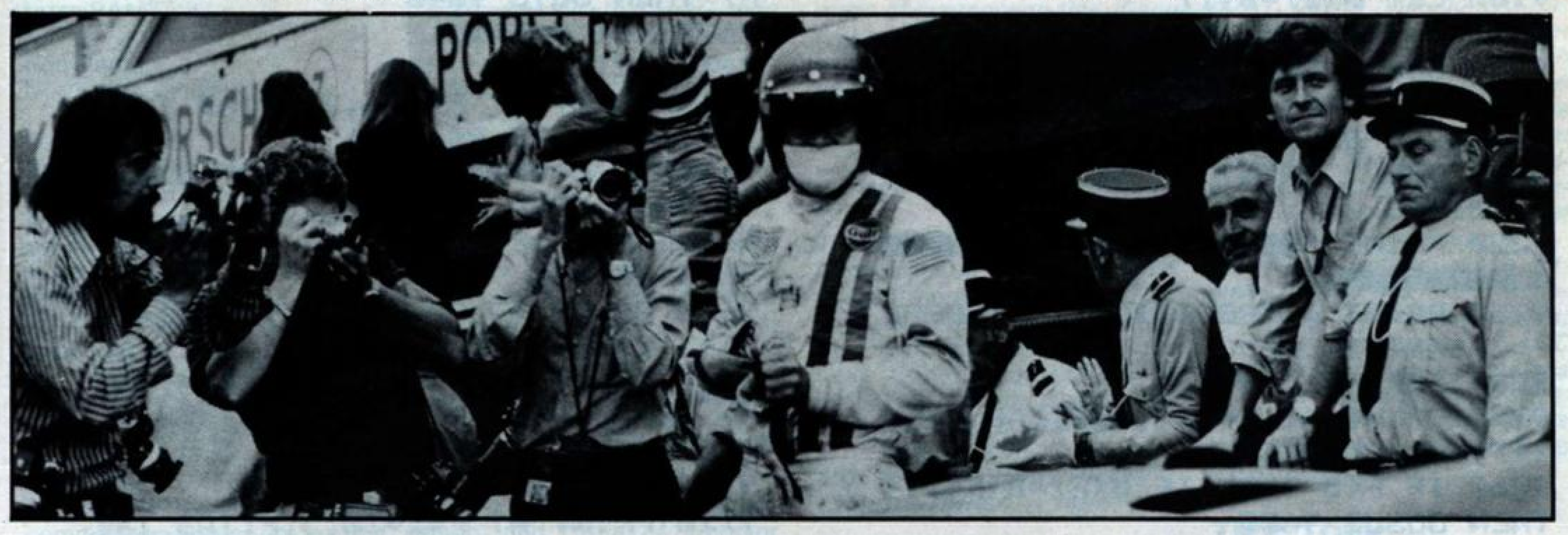
C,D	co-ordinates for road.
F	for/next loops.
S	score.
W	display file peek for a crash.
X,Y	co-ordinates for car.
Z	co-ordinates of previous position of car.

Variables used for the high score routine

B(x)	high score x.
B$ (x)	initials x.
F	for/next loops.
G	for/next loops.
I$	current initials.
S	current score.
X	for/next loops.
Z$	save name.

Graphics Notes

Line 140	2 inverse spaces, 4 graphic A's, 2 inverse spaces. 1 graphic H.
Line 150	1 inverse H.
Line 180	1 inverse H.
Line 9220	9 inverse spaces, inverse "HIGHEST SCORES", 9 inverse spaces.




```
  1 REM    SET UP ARRAYS
  2 DIM B(5)
  3 DIM B$(5,4)
  5 REM    DRIVING SKILL GAME
 10 LET C=21
 20 LET D=12
 30 LET X=8
 40 LET Y=16
 50 LET S=0
 60 LET Z=Y
 70 LET D=D+(SGN (16-(RND*32)))
 80 IF D<0 THEN LET D=0
 90 IF D>23 THEN LET D=23
100 SCROLL
110 LET Y=Y-(INKEY$="5")+(INKEY
$="8")
120 LET W=PEEK ((PEEK 16396+256
*PEEK 16397)+265+Y)
130 LET S=S+1
135 REM GRAPHICS IN NEXT LINE
         ARE 2 INVERSE SPACES +
         4 GRAPHIC KEY "A" +
         2 INVERSE SPACES THEN
         A GRAPHIC KEY "H"
140 PRINT AT C,D;"██▒▒▒▒██";TAB
31;" ";AT X,Y;"H";AT X-1,Z;"▒"
150 IF RND>(.65-S/2000) THEN PR
INT AT C,D+(RND*3+2);"[H]"
160 IF W<>128 AND W<>173 THEN G
OTO 60
170 FOR F=0 TO 15
180 PRINT AT X,Y;"[H]";AT X,Y;"H"
;AT X,Y;" "
190 NEXT F
```

▶

```
200 PRINT AT X,Y;"H";AT 21,D;"S
CORE:";S
8999 REM   HI-SCORE ROUTINE
9000 FOR X=0 TO 100
9010 NEXT X
9020 CLS
9029 REM    CHECK IF SCORE IS
      LESS THAN FIFTH
      HI-SCORE
9030 IF S<B(5) THEN GOTO 9500
9040 FOR G=1 TO 5
9049 REM   FIND WHICH HI-SCORE
     THE CURRENT SCORE IS
9050 IF S<B(G) THEN NEXT G
9060 IF G=5 THEN GOTO 9180
9070 LET B(5)=B(4)
9080 LET B$(5)=B$(4)
9090 IF G=4 THEN GOTO 9180
9100 LET B(4)=B(3)
9110 LET B$(4)=B$(3)
9120 IF G=3 THEN GOTO 9180
9130 LET B(3)=B(2)
9140 LET B$(3)=B$(2)
9150 IF G=2 THEN GOTO 9180
9160 LET B(2)=B(1)
9170 LET B$(2)=B$(1)
9180 GOSUB 9800
9190 LET B(G)=S
9200 LET B$(G)=I$
9209 REM   PRINT HI-SCORES
9210 CLS
9220 PRINT "           HIGHEST SCO
RES           "
9230 PRINT ,,"POSITION     SCORE
      INITIALS"
9240 FOR F=1 TO 5
9250 PRINT AT F*2+2,3;F;TAB 14;B
(F);TAB 25;B$(F)
9260 IF F<5 THEN IF B(F)=B(F+1)
THEN GOSUB 9600
9270 NEXT F
9280 PRINT AT 19,0;"PRESS S TO S
AVE",,"OR ANY OTHER KEY TO PLAY
AGAIN"
9290 IF INKEY$="S" THEN GOTO 940
0
9300 IF INKEY$="" THEN GOTO 9280

9310 CLS
9320 GOTO 10
9399 REM    SAVE ROUTINE
9400 CLS
9410 PRINT "SAVE ROUTINE",,,,"EN
TER PROGRAM NAME",,,
9420 INPUT Z$
9430 PRINT "PRESS ANY KEY TO SAV
E"
9440 IF INKEY$="" THEN GOTO 9440

9450 SAVE Z$
9460 CLS
9470 GOTO 9210
9499 REM    PRINT LOWER SCORE
        THAN 5TH HI-SCORE
9500 PRINT "YOU HAVE A LOWER SCO
RE THAN     FIFTH",,,,"BETTER LU
CK NEXT TIME"
9510 FOR F=0 TO 60
9520 NEXT F
9530 GOTO 9210
9599 REM PRINTS EQUAL PLACES
9600 PRINT AT F*2+4,3;F;TAB 14;B
(F+1);TAB 25;B$(F+1)
9610 IF F+2<=5 THEN IF B(F+2)=B(
F) THEN GOTO 9640
9620 LET F=F+1
9630 RETURN
9640 PRINT AT F*2+6,3;F;TAB 14;B
(F+2);TAB 25;B$(F+2)
9650 IF F+3<=5 THEN IF B(F+3)=B(
F) THEN GOTO 9680
9660 LET F=F+2
9670 RETURN
9680 PRINT AT F*2+8,3;F;TAB 14;B
(F+3);TAB 25;B$(F+3)
9690 IF F+4<=5 THEN IF B(F+4)=B(
F) THEN GOTO 9720
9700 LET F=F+3
9710 RETURN
9720 PRINT AT F*2+10,3;F;TAB 14;
B(F+4);TAB 25;B$(F+4)
9730 LET F=F+4
9740 RETURN
9799 REM    INPUT INITIALS
9800 PRINT "YOUR POSITION IS ";G
,,,"INPUT YOUR INITIALS"
9810 INPUT I$
9820 PRINT AT 0,0;"
   "
9830 RETURN
```

QUICKSOFT

Clive Smith, the terror of the software scene, passes judgement on some new software

Space Shuttle
Activision
Spectrum 48K
£9.99

A simulation game based on the American space shuttle which takes you from launch site to outer space and back. The object is to retrieve satellites which have become unstable and return them to Earth, making as many flights as possible on a set amount of fuel.

The tape comes with a very comprehensive instruction manual which looks as if it's come directly from NASA. I locked myself in the loo and studied it for an hour or two (the book of course, not the loo).

"WOW", I thought to myself, "This really looks exciting", just about everything has gone into this game. I rushed to the computer, loaded the tape and ran the demo.

Well I have to admit (in disagreement with the Ed) that I found the graphics rather boring. It's not that they are badly drawn, but the instrument panel is rather sparse and visually there is not a lot to see.

The top half of the screen is taken up with the window of the shuttle and the lower half is the instrument panel. this consists of two sliding scales, one with a thrust indicator on it which shoots up and down, and another which you control. The idea is to match your indicator with the thrust one in order to achieve maximum fuel economy. Below that is a small screen which gives you data reports such as altitude, countdown time, fuel, position and docking. Another small screen shows your trajectory path for take-off and docking.

At the bottom left & right is a front view of the shuttle which graphically shows you when your wheels are down and if the cargo doors are open or shut.

After you have checked through the controls you are ready for launch and at T minus 15 seconds you activate the main engines. At −004 you ignite the engine and wait till the hold-down bolts release and you blast into space.

One of the effects I did like was the vibration of the screen at lift off and the way the clouds seen through the window suddenly disappear. As the shuttle takes off you have to steer it via the joystick on its trajectory path. When at 210 miles you have to shut off the engines and open the cargo doors to dissipate heat. Through the window you see the earth below, which is a series of lines constantly moving to give a global effect. Using the tracking screen you have to find the satellite and dock with it.

At this point I was hoping to see the cargo bay and a controlled arm come out and retrieve the satellite, but not so. Once docked with it, it just seems to leap aboard. Now, you have to leave orbit and attempt re-entry. As you enter the Earth's atmosphere you start to burn, and the effect in the window as the heat builds up is astounding, (the instruments go haywire as there is build up of ions).

Once below the clouds you see the landing strip and you need to go through the landing sequence to bring it down. You will find your fingers are constantly in use as you fire primary engines, keep the shuttle on course as it turns on three axes and go through each sequence with absolute precision.

To sum up, I thought the graphics a bit of a let-down but a hard and accurate game to play. With some flight simulation games, after an hour of use, you really feel that you have flown a plane, but I didn't get the same feeling with this one. May I suggest that if you are interested in this one try and see the demo before you buy it, but, as I said, the Editor liked it.

MINI OFFICE
Database Software
Spectrum 48K
£4.95

A selection of mini business programs on one tape. On one side you get a word processor and database, and on the other, a spreadsheet and graphics program.

These programs do have their limitations, so if you're running a large business I would look for something a little more suitable. However, if you run a small shop or clubhouse and have limited funds you may find this ideal for your needs.

The tape itself comes in a standard cassette case with an easy to follow, 31 page, cassette size instruction manual. Taking each program in turn, I first looked at the word processor. It's not the world's best, but it is adequate for letter writing and suchlike. It carries out the same sort of functions a standard typewriter would do, with the added bonus of being able to change or finish off your letter before it's actually printed. One useful feature is that if your eyesight is not up to scratch, you can enlarge the characters to twice their normal size. It also gives you four Tab positions and the ability to count the number of words used as you type. The maximum is 30,000 which is an awful lot.

Moving on along the tape is the database. It's not bad, and I've seen worse. It will hold 12 fields per record with a maximum of 131 records. You can use numeric or strings wherever you want and the search routine will find part or whole strings. This can be carried out in separate fields if needed. One nice item is that it will multi-sort, either alphabetically or numerically. You can of course delete/add records if needed and LOAD/SAVE data if wished. An ideal database for names and addresses, club members etc.

Flicking over the tape is the spreadsheet. If you want to know what a spreadsheet is, read my review in the last issue. If you didn't buy one, serves you right.

This spreadsheet has 20 columns and 30 rows and will perform most of the functions on the Spectrum. Commands are easy as a1 + b1 + c1 = d1. It also has the ability to carry functions across rows and columns with one press of a key. You can LOAD/SAVE data and this is where the graphics program comes in. After saving the spreadsheet data you load the graphics program and then reload the data. The graphics program will then produce a histogram, pie chart, line chart or percentage information. The data can be saved for re-use back into the spreadsheet.

Overall a nice little package. Though limited, it will carry out all the basic needs of the mini user. Mini Office is available from Database Software, Europa House, 68 Chester Road, Hazel Grove, Stockport.

KWIKLOAD
Data View Software
Spectrum 48K
£4.99

Kwikload, as the name suggests, enables you to SAVE or LOAD your programs three times faster than conventional methods. Not only can it be used with your own programs, but it will also convert published programs as well. They claim to cut down loading times of The Hobbit to 120 seconds and Scrabble down to 136 seconds.

I think it's only fair to point out they do not condone piracy.

With the tape you get a 12 page (A12) instruction booklet. This is easy to follow and anyone with average knowledge of programming should find it quite simple. The only problem I found is that you have to buy a good quality tape as the smallest gap in the oxide will cause it to fail.

For the technical, the Spectrum transmits at 1500 baud and Kwikload improves this to 4500 baud. All program leaders are disposed of to improve times even more.

For data protection what could be better. In fact the whole thing is a little bit like upgrading your C5 to a 3.5 litre car. ■

Tasword to the limit

We rejoin John Wase who discovered Tasword II in the last issue, as he struggles with the Epsom UDG's.

```
 100 REM Program "newchars"
 105 REM Download Printer's Char
acter Set from its ROM to its RA
M
 110 LPRINT CHR$ (27);":";CHR$ (
0);CHR$ (0);CHR$ (0);
 115 REM  Select RAM character.s
et for use
 120 LPRINT CHR$ (27);"%"; CHR$
(1);CHR$ (0);
 125 REM Modify characters a, b
and u to give Greek characters
 130'LPRINT CHR$ (27);"&"; CHR$
(0);"aa";: GO SUB 250
 131 LPRINT CHR$ (27);"&"; CHR$
(0);"bb";: GO SUB 250
 132 LPRINT CHR$ (27);"&"; CHR$
(0);"uu";: GO SUB 250
 199 GO SUB 9000
 200 STOP
 250 POKE 23298,195: POKE 23299,
214
 260>FOR a=1 TO 12: READ E: LPRI
NT CHR$ (E);: NEXT a
 270 POKE 23298,202: POKE 23299,
25
 280 RETURN
 500 DATA 139,12,18,0,34,0,34,16
,12,50,0,0
 550 DATA 11,7,56,64,130,16,130,
16,98,12,0,0
 600 DATA 11,0,127,0,8,0,8,0,112
,8,0,0
8995 REM Print modified characte
rs to check accuracy
9000 LPRINT "a": LPRINT "b": LPR
INT "u"
9010 RETURN
```

Figure 1. Down Loading program.

Continued from part one...

All this was very satisfying, but I still had to find out how to include symbols like α, β or μ and some of the symbols used on graphs. For this, I needed to download and modify the Epson character set, and whilst I was sure that this could be done, I once again failed miserably with the Epson manual. So this time it was Epsons' turn to be badgered. They were also particularly helpful, and sent me a copy of some American instructions which were *very* colloquial (What gives... It's a breeze...), but well written: without it I don't think I should have succeeded. From this I was eventually able to devise a program to download and modify the character set. Let's look at how we can change three keys at will within Tasword: we will arrange things so that we can access α, β and μ from keys a, b and u.

The first thing to do is to ensure that the Printer's RAM is available. On the Epsons it can serve a dual function, acting as an extra large buffer if it is not needed for the sort of purpose described here and, specifically in the FX80, switch 1-4 must be set at "off" to ensure availability. The printer interface software is then loaded. Mine has two lines of BASIC loader: program lines 1 and 2, followed by machine code which is located in the printer buffer. Once it is loaded, it auto-runs; the two BASIC lines must then be deleted, either by editing them out, or using MERGE for the following program; a bit of a fiddle, but NEWing makes the machine code in the printer buffer unavailable. Then the BASIC downloading program (figure 1) is LOADed and RUN, after which the Spectrum, but *not* the printer, is reset, so that Tasword Two can be loaded. Line 110 downloads the character set to the printer's RAM and line 120 selects the RAM character set for use, (more about this later), so that the new characters are printed out to check that they have been defined correctly. Line 130 selects character "a" to be modified: in its general form the "aa" can be changed to "az", for instance, and then characters a to z will be modified; alternatively the ASCII codes can be used; the printer will accept either, but this will involve modification of other parts of the program. Line 260 then transmits the data and line 9000 finally prints out the character. How exactly, then is a character defined, and what on earth is the function of lines 250 and 270?

Beta

Perhaps if I show how the data for my own β was assembled, it will make things clear. The first thing to do is to draw a grid, as in

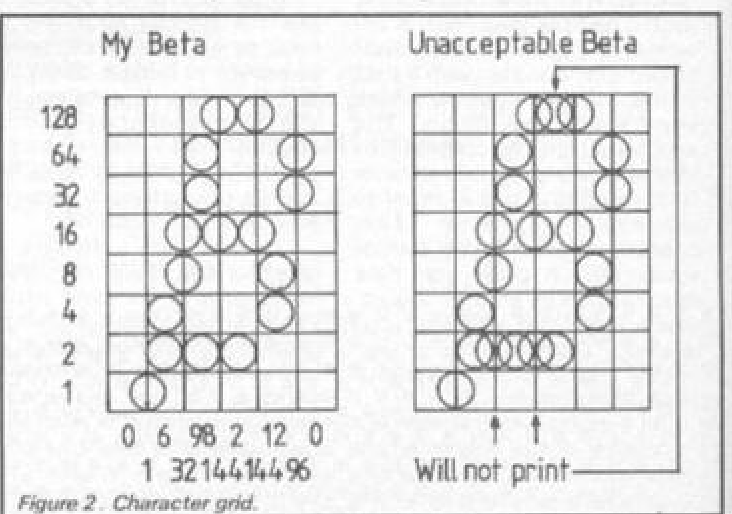


Figure 2. Character grid.

figure 2, allowing 11 columns of overlapping dots. Whilst the printer itself will not print overlapping dots, the columns can overlap: the picture makes this clear. Make the grid 8 spaces high. But, you will say, there are 12 data numbers. And the FX80 dot matrix is nine dots tall. True, but either the top eight pins or the bottom eight pins are used for printing, the latter for lower case letters with descenders. This is determined by the first byte; the attribute byte, which can also carry information for proportional spacing, but in this case we need not be concerned with this. An attribute byte whose decimal code is 139 will cause the top eight pins to print 11 columns, (128 + 11); a code of 11 will cause the bottom eight pins to print similarly. Then, for each of the following 11 columns, add the numbers shown on the left of the diagram which coincide with the dots in that column. And there is the decimal code for β. Try it and see. In this case the complete code is 139, 0, 1, 6, 32, 98, 144, 2, 144, 12, 96, 0.

Now, what about lines 250 and 270? Well, perhaps I had better explain what happened when I first tried to download some characters without these POKES. Being lazy, I had previously contacted my friends in the University micro-users' group, who had supplied me with a download character set devised by our Mathematics Department, who had spent many long hours discussing the optimum shape of a Greek letter or a curly-wurly bracket. This set was in the form of a listing suitable for the B✱ ✱ B. And so, I had merely lifted their data. All went well with α and μ. But with β I got a most curious thing that looked rather like a distorted "K". Having less faith than I ought to have had in their data, I merely thought that some of it was wrong, and devised my own β instead. This was murder; on telling the printer to print, it printed RR, spat my A4 page out and printed some funny dots and dashes on the rubber platen. Well, eventually my friends worked out that it was only the high order ASCII codes which were giving trouble, and subsequently after a call to Kempston, all was made clear. The high order codes are used by Sinclair for his keywords, in other words, they are single byte tokens. In order that LLIST should work correctly, the interface driver-software contains routines to interpret these tokens so that the full keywords are printed out. In the Kempton interface instructions you are told the pokes to switch off these tokens — if you know what is meant by tokens! The garbage which was getting through to the printer when I defined a β was certainly not what I had intended and this explained the excitement the printer was suffering (see fig. 3).

Incidentally, owners of interfaces with EPROM software might find that it is not possible to switch off the tokens: do check before buying if you are intending to use a downloaded character set.

```
THE MATHEMATICS DEPARTMENT BETA DOWNLOADED CORRECTLY

ββββββββββββββββββββ

THE MATHEMATICS DEPARTMENT BETA DOWNLOADED WHEN TOKENS HAVE NOT
BEEN SWITCHED OFF

ββββββββββββββββββββ
```

Figure 3.

```
SCREEN DUMP OF PRINTER CONTROL CODES (VERSION 1)

            Tasword Two
     © Tasman Software 1983
Printer control graphics chars:

128          27    84
     129     20
130          41    27    84    0
     131     27    45    0
132          27    53
     133     27    70
134          32    32    32
     135     27    84
136          27    83    1
     137     32    32
138          27    69
     139     27    52
140          27    45    1
     141     27    83    0    40
142          14
     143     27    83    0


SCREEN DUMP OF PRINTER CONTROL CODES (VERSION 2)

            Tasword Two
     © Tasman Software 1983
Printer control graphics chars:

128          27    64
     129     20
130          27    37    0
     131     27    45    0
132          27    53
     133     27    70
134          32    32    32
     135     27    84
136          27    83    1
     137     32    32
138          27    69
     139     27    52
140          27    45    1
     141     27    37    1
142          14
     143     27    83    0
```

Figure 4a.

KEY TO DUMPS OF PRINTER CONTROL CODES

Graphics Character	ASCII Code	Function
		Version 1
1S*	142	Enlarged Type on.
1	129	Enlarged Type off.
2S°	141	Superscript on; Print superscript "(".
2 °	130	Print superscript ")"; superscript off.
3S	140	Underline on.
3	131	Underline off.
4S	139	Italics on.
4	132	Italics off.
5S	138	Emphasized Mode on.
5	133	Emphasized Mode off.
6S	137	Double Space (pad).
6	134	Triple Space (pad).
7S	136	Subscript on.
7	135	Subscript off.
8S	143	Superscript on.
8	128	Superscript off.
		Version 2 is the same as version 1 except:
2S	141	Downloaded Characters, (printer RAM), selected
2	130	Printer ROM character set selected

* S = Shifted
° Definition of a bracket with superscript can be useful for certain systems of referencing, and the bracket in the printer code avoids the use of pads.

Figure 4b.

Printer Codes

Well, at last I was able to do what I set out to do. All that remained was to modify the printer codes once again. Line 120 of my program shows that the decimal code for selection of the RAM character set is 27, 37, 1, and that for selection of the ROM set is 27, 37, 0. Once again I had to make a decision: graphics 2, (originally select and deselect condensed typeface), was sacrificed. (My personal set of Tasword Two decimal codes which I use to instruct the printer, together with the graphics keys on which they have been defined are given in figures 4a, 4b, along with their functions.) And so I was away!

As can be seen from the example, it is possible to type less-than-straightforward text using Tasword Two. Even complicated formulae are relatively simple to insert, and the whole can be carried out at professional speed: I really am extremely satisfied with the system I now own.

PRINTER CRIBSHEET FOR EASY PAGINATION

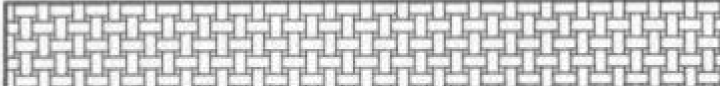
Page	Start line	Finish line
1	1	30
2	31	60
3	61	90
4	91	120
5	121	150
6	151	180
7	181	210
8	211	240
9	241	270
10	271	300

Figure 5.

Some Tips

A few odd tips to help your work run smoothly. There is no auto page-numbering feature on Tasword Two; not surprising, since the RAM will only hold 320 lines. Most documents on A4 paper fit very well with double-spacing at 30 lines to the page unless there are many lines, (e.g. headings), printed in enlarged typeface. I therefore keep a cribsheet as illustrated pasted to the printer (fig. 5); it is invaluable when the Tasword menu asks for start and finish lines. The first line printed out on page 1 of a document is always Textfile somename; pages 1 to 10 are recorded as somename, 11 to 20 as somename 2, and so on; different versions of the same file are labelled with a, b, etc. A folder of all the first pages is also kept; in this way, that pile of cassettes or discs can always be kept under control.

All that is left now is to tidy up some loose ends. The complete Mathematical Character Set is illustrated (fig. 6); the data to enable downloading has been made available to me by our Mathematics Department, to whose Dr. Mike Beilby I am extremely grateful. (Users requiring copies of the data should apply direct to me, at the Department of Chemical Engineering.) Help was also freely given by Esther Bayer (Epson, (UK), Ltd.); Keith Archer (Kempston Microelectronics, Ltd); Tasman Software; Dr. Andy Wright (Betasoft); and Dr. Duncan Banks (UBUG).



DOWNLOADED CHARACTER SET DEVISED BY THE MATHEMATICS DEPARTMENT,

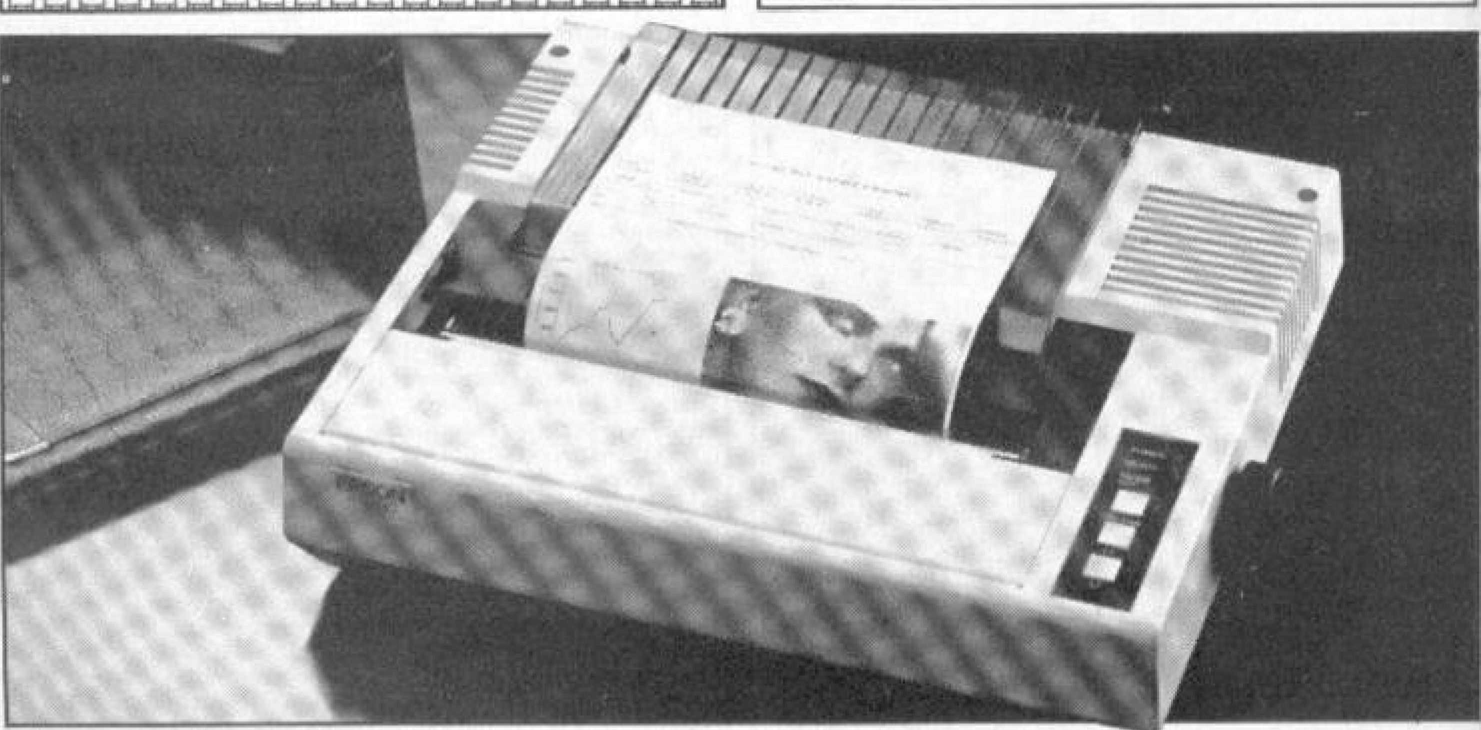
UNIVERSITY OF BIRMINGHAM

Mathematics characters

normal	altern	maths	math alt	normal	altern	maths	math alt
a	*a*	α		A	*A*		∀
b	*b*	β		B	*B*	B	
c	*c*	γ		C	*C*	Γ	€
d	*d*	δ	∂	D	*D*	Δ	⊃
e	*e*	ε	∈	E	*E*	Ǝ	⊂
f	*f*	φ		F	*F*	∃	∍
g	*g*	θ		G	*G*	∇	□
h	*h*	η	ħ	H	*H*	Θ	
i	*i*	ι	ι	I	*I*	I	∫
j	*j*	ψ	)	J	*J*	ℑ	
k	*k*	κ		K	*K*	K	
l	*l*	λ	ℓ	L	*L*	Λ	∠
m	*m*	μ		M	*M*	M	
n	*n*	ν		N	*N*	N	ℕ
o	*o*	ø	•	O	*O*	Θ	•
p	*p*	π		P	*P*	Π	
q	*q*	χ		Q	*Q*	Ξ	ℚ
r	*r*	ρ		R	*R*	P	ℝ
s	*s*	σ		S	*S*	Σ	∋
t	*t*	τ		T	*T*	T	
u	*u*	υ	∪	U	*U*	Υ	∪
v	*v*	ϕ	∩	V	*V*	Φ	∩
w	*w*	ω		W	*W*	Ω	
x	*x*	ξ	×	X	*X*	X	×
y	*y*	ψ		Y	*Y*	H	⊗
z	*z*	ζ		Z	*Z*	Z	ℤ
[	*[*	⌈	⌊	]	*]*	⌉	⌋
{	*{*	⌠	⌊	}	*}*	\	/
(	*(*	(	\	)	*)*	\	/
\	\	|	‡	%	*%*	⌡	)
						⌠	⌡
0	*0*	0	∅	#	#	⌐	∠
1	*1*	1		!	*/*	∫	∮
2	*2*	2		"	"		
3	*3*	3		#	#		
4	*4*	4		?	*?*	§	
5	*5*	5		~	~	≥	•
6	*6*	6		-	-	-	◦
7	*7*	7	?	*	*	ε	•
8	*8*	8		+	+	+	●
9	*9*	9		-	-	-	
-	-	—	T	/	/	⌐	,
!	*!*	⊃	÷	$	*$*		
<	*<*	◆	÷	>	*>*	◆	-
@	*@*	∪	÷	^	^	≠	†
.	.		◦	,	,	↑	L
&	&	∝	=				

(£)

Figure 6.



Problem page

David Nowotnik answers your questions

RAMTOP

Dear David,
I have just read your article on "First Steps in Machine Code". I was confused when you said that:

```
10 POKE 16388,47
20 POKE 16389,117
```

lowers RAMTOP on the ZX81 to 29999. Could you explain how changing these addresses affects RAMTOP?

Ken Duda,
Northlake, Illinois, USA

Dear Ken,
Sorry if it wasn't clear, but this is how it works. The ZX81 stores some variables (system variables) which are important to its operation. One of these variables is the position of RAMTOP. This variable is stored in two bytes, at addresses 16388 and 16389. The position of RAMTOP is calculated as the value in 16388 plus 256 times the value in 16389 (47 + 256 × 117 = 29999). The position of RAMTOP is normally set by the computer on power-up, when it determines how much RAM is available. But, you can alter RAMTOP by placing new values in the addresses 16388 and 16389. As I explain elsewhere in this issue, this has to be done with care.

Fill-in

Dear David,
I am attempting to write a machine code program to fill in shapes drawn on the screen. I am having problems because I do not know where the ROM's POINT routine is situated. Could you please tell me where this is, and how to use it?

Greg Woods,
Bayhorse, Lancaster

Dear Greg,
The Spectrum's POINT routine starts at address 22CB (hex). The first thing the routine does is to pull from the calculator stack the x and y coordinates, and place them into registers B and C. In your routine, you could avoid this by placing the x and y values directly into B and C, then calling 22CE. The routine places the value 1 (for ink) or 0 (for paper) onto the calculator stack, from where you can retrieve it.

Vertical strings

Dear David'
Before owning a Spectrum, I had a Tandy Model 1. With the Tandy, it was possible to assemble what I called 'vertical strings', e.g.

```
LET a$ = "123" + CHR$ (26) + CHR$ (24) + CHR$ (24) - + "456"
```

where CHR$ (26) = cursor down, and CHR$ (24) = cursor left. The command PRINT a$ then gives:

```
123
456
```

This doesn't appear to work when using the Spectrum cursor codes (10 and 8) in the same way. The command PRINT a$ gives:

```
456
```

where backspace works, but line feed does not, so '123' is overwritten by '456'. Can I assemble 'vertical strings' on the Spectrum?

P. V. Bamfield
Brighton, East Sussex

Dear Mr. Bamfield,
You've spotted an interesting 'bug' in the Spectrum, the failure of the up and down cursor control characters to work with PRINT. There are a number of ways of overcoming this, if you want 'vertical strings'. For the simple example you give, you could easily use the 'ENTER' control character (13); that is:

```
LET a$ = "123" + CHR$ 13 + "456"
```

This doesn't give you much flexibility, but you can get that with the 'AT' control character (22). If you use PRINT CHR$ 22, then the Spectrum thinks that the next two characters to be 'PRINTed' are the coordinates used with AT, for example:

```
LET a$ = "123" + CHR$ 22 + CHR$ 8 + CHR$ 4 + "456",
```

then PRINT a$, and you'll get '123' at the top left of the screen, and '456' starting at position 8,4.

R.A.T.

Dear David,
I recently purchased a R.A.T. Remote Control Transmitter for use with my 48K Spectrum. I am unable to get any results with the games tapes I already have; apparently they are not Kempston Joystick compatible. Can I overcome this? Can I use game programs from listings in 'ZX Computing' with this device?

J. W. Shaw,
Ashurst, Southampton

Dear Mr. Shaw,
There are a number of joystick systems for the Spectrum, but the two most popular are, the Kempston, and Sinclair's own with their ZX Interface 2. These two are incompatible, so a game written for one cannot work with the other system. Most games allowing the use of joysticks are written for use with Kempston joysticks, and the R.A.T. device has adopted this system. So, you're unlucky not to have some games which work with R.A.T. Virtually all commercially available games are written in machine code, so the joystick 'standard' is embedded in them, with little opportunity for the average user of changing that standard.

Program listings are a different matter. The R.A.T. is supplied with detailed instructions, including how to write BASIC (and machine code) instructions to 'listen' to your RAT commands. So, you should be able to modify listings according to those instructions.

Tick-Tock

Dear David,
The internal clock on the Sinclair QL is very useful for games in which time is important. However, I'm not too sure how to set it to zero. Can you help?

Robin Miller,
Aylesbury, Bucks

Dear Robin,
If you are not concerned abut the date stored by the QL's internal clock, then the simplest way of resetting the clock is the instruction:

ADATE (– DATE)

This 'zeros' the date, as well as the time.

Conversion tips

A guide to ZX81/Spectrum program conversions from David Nowotnik.

The versions of BASIC offered by the two ZX computers are so similar that many programs for one can be used by the other. The ZX81 has only two commands which are not present on the Spectrum, SCROLL and UNPLOT, and these should cause you few problems when converting ZX81 programs to the Spectrum (see Table 1).

There are quite a lot of commands and functions on the Spectrum which are not available on the ZX81. A list of these appears in Table 4. The stars indicate those commands and functions for which there is no simple translation to ZX81 BASIC. Those for colour and sound can be ommitted; but you will have to find some alternative for the high resolution and file I/O commands.

The command PLOT appears on both computers, but the effect is quite different, so beware! Another tip: PEEK and POKE should be used with caution. In conversion, addresses will almost certainly have to be changed. Some of those changes appear in the tables. A command such as POKE USR "a" . . . . on the Spectrum indicates User Defined Graphics; ZX81 users don't have this facility, so you'll have to omit this and use a standard character instead.

ZX81	Spectrum	Comments
SCROLL	RANDOMISE USR 3582 or LET t=USR 3582	If the program uses random numbers, they could become rather predictable with the first option. If so, use the second, using a variable (in this case t) which is otherwise not used.
PLOT Y,X	PRINT AT 21−Y/2,X/2;	Print the appropriate quarter square graphics character.
UNPLOT Y,X	PRINT AT 21−Y/2,X/2;	Print a space, or the appropriate quarter square graphics character.

Table 1 ZX81 to Spectrum conversions.

Spectrum	ZX81	Comments
BIN eg LET y=BIN 10010101	LET y=(decimal no.) Conversion to decimal: 10010101=149 128 64 32 16 8 4 2 1 Add these numbers together when a 1 appears at the appropriate position in binary.	BIN allows the representation of a number in binary. On the ZX81 use the decimal equivalent, but beware; BIN is often used with User Defined Graphics, which are not available on the ZX81.
READ/DATA eg READ x,y DATA 50,60	LET LET X=50 LET Y=60	READ and DATA are used to store a lot of information in a program. Use LET instead.
DEF FN and FN eg DEF a(x)=SQR x LET t=FN a(i)	LET X$="SQR X" LET X=I LET T= VAL X$	The defined function can appear in a string. Use the keyword for built-in functions (eg SQR). The equivalent of FN may need 2 lines, as shown.
PLOT	no equivalent	
SCREEN$ eg LET a=SCREEN$ x,y	LET A=PEEK(PEEK 16396 +256*PEEK 16397+1+Y+33*X)	Used in interactive games to detect characters in the display file. Note — this formula only works when a RAM pack is fitted.

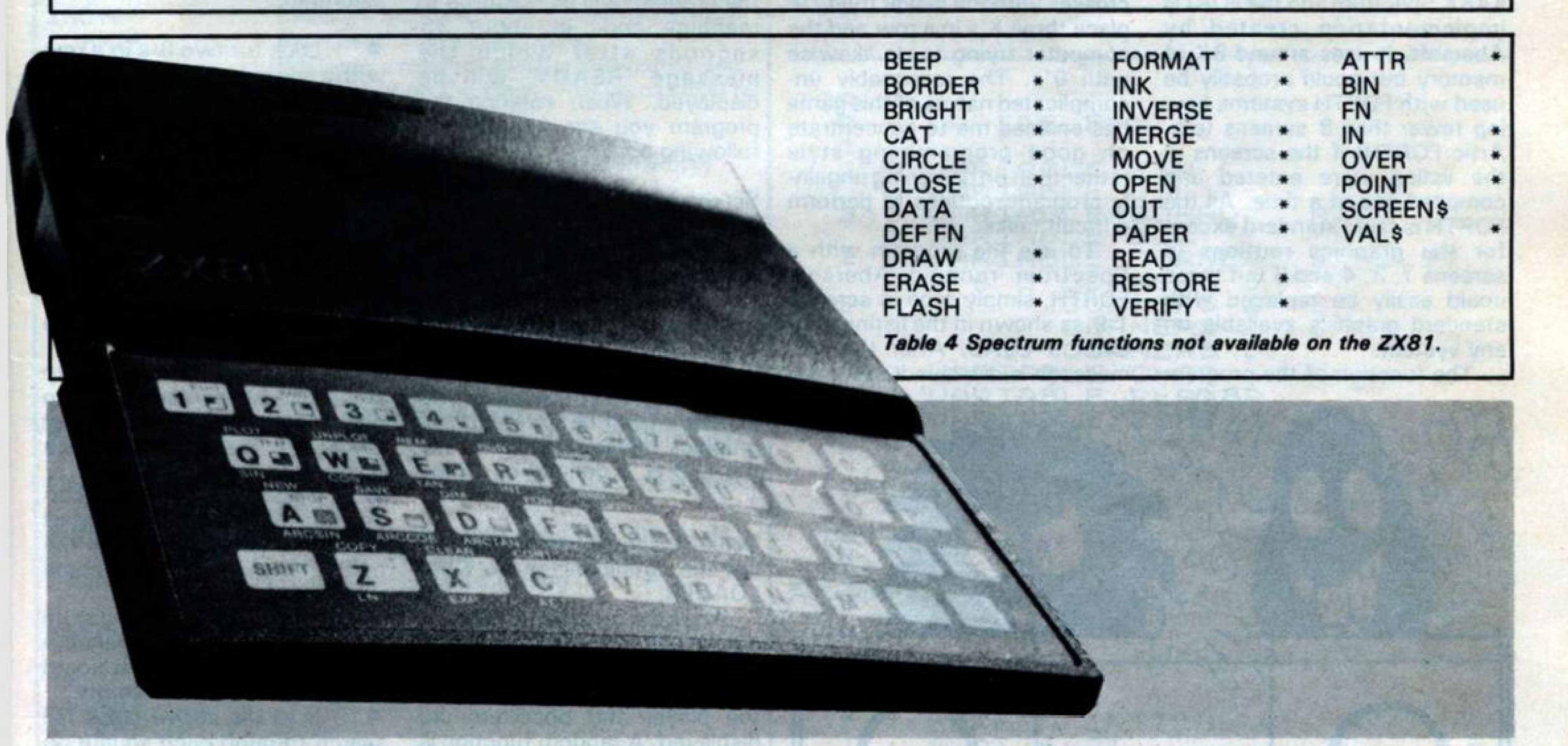
Table 2 Spectrum to ZX81 conversions.

ZX81	Spectrum	Comments
1 FRAMES POKE 16436,255 POKE 16437,255	POKE 23672,0:POKE 23673,0	Both computers have a counter which accurately varies by 50 every second. In the example, use the first line to start the 'clock'. The variable T will have the time in seconds after the start. The counter can only be used for 10 minutes.
LET T=(65535−PEEK 16436−256*PEEK 16437)/50	LET t=(PEEK 23672+256*PEEK 23673)/50 For times greater than 10 minutes, you can use byte 23674 as well.	
2 Line number zero POKE 16510,0	POKE 23756,0 (As the start of BASIC can move, eg with microdrives) use with caution.	Converts the first line of a program to line number zero. which cannot be edited, and so is protected.
3 RAMTOP POKE 16388,X−256*INT (X/256) POKE 16389, INT (X/256)	CLEAR x	Creates a safe area at the top of RAM starting at address x, for storing data, machine code etc.

Table 3 General interconversion hints.

BEEP	*	FORMAT	*	ATTR	*
BORDER	*	INK	*	BIN	
BRIGHT	*	INVERSE		FN	
CAT	*	MERGE	*	IN	*
CIRCLE	*	MOVE	*	OVER	*
CLOSE	*	OPEN	*	POINT	*
DATA		OUT	*	SCREEN$	
DEF FN		PAPER	*	VAL$	*
DRAW	*	READ			
ERASE	*	RESTORE	*		
FLASH	*	VERIFY	*		

Table 4 Spectrum functions not available on the ZX81.



System Variables Conversion Table.

Variable	ZX81/ T/S1000	Spectrum/ TS2068
BREG	16414	23655
CDFLAG	16443	No Equivalent
CH ADD	16406	23645
COORDS	16438	23677
COORDS (Byte 2)	16439	23678
DEST	16402	23629
DF CC	16398	23684
D FILE	16396	No Equivalent
DF SZ	16418	23659
E LINE	16404	23641
ERR NR	16384	23610
E PPC	16294	23625
ERR SP	16386	23613
FLAGS	16385	23611
FLAGX	16429	23665
FRAMES	16436	23672
LAST K	16421	23560
MARGIN	16424	No Equivalent
MEM	16415	23656
MEMBOTT	16477	23698
MODE	16390	23617
NXTLIN	16425	23637
OLDPCC	16427	23662
PPC	16391	23621
PRBUFF	16444	23296
PR CC	16440	23680
RAMTOP	16388	23730
SEED	16434	23670
S PSN	16441	23688
S POSN (Byte 2)	16442	23689
STKBOT	16410	23651
STKEND	16412	23653
S TOP	16419	23660
STRLEN	16430	23666
T-ADDR	16432	23668
VARS	16400	23627
VERSN	16393	No Equivalent
X PTR	16408	23647

Oxo Flavoured Forth

Richard Armstrong of Ayrshire wrote this program in Abersoft Forth and we decided to print it for all addicts of this language!

This program was written using a 48 K Spectrum and the FORTH implementation created by Abersoft. It uses around 8 K of memory but could probably be used with FORTH systems having fewer than 8 screens (e.g. Artic FORTH) if the screens in the listing were entered and compiled one at a time. All the FORTH is fairly standard except for the graphics routines in screens 1, 3, 4 and 5 but these could easily be replaced with standard graphics available on any system.

The function of the program is to play a game of noughts and crosses with the player trying to place three X's in a row and the computer trying to do likewise with 0's. The reasonably uncomplicated nature of this game has enabled me to concentrate on good programming style rather than on designing ungainly program routines to perform difficult tasks.

To use the program with a Spectrum running Abersoft FORTH, simply type in screens 1-9 as shown in the listing then enter 9 LOAD. After the 'ok' message is displayed, enter the word LOADER and the text of the program will be compiled to machine code in about 35 seconds after which the message 'READY' will be displayed. When entering the program you should note the following points:

Screen one is used to define graphic characters and so should only be used with Abersoft FORTH.

In lines 1, 2, 4 and 5 of screen 3, lines 1, 2 and 3 of screen 4 and lines 1, 2 and 3 of screen 5 the capital letters inside string quotes should be entered from graphics mode since these are the U.D.G.'s defined in screen 1.

Screen 9 should contain nothing but the definition for the word LOADER.

After the message READY is displayed, the game can be started by entering RUN. A 3x3 grid is then drawn and scores for the player and Spectrum are displayed. A random function is used to determine whether the computer or the player moves first. When prompted by the message 'Your Move', the player should make a move by pressing the number key on the Spectrum's keyboard corresponding to the number in the square he wishes to move into. For example, to place an X in the square at the centre of the grid press key '5'. The computer will ignore keys outside the range 1-9, or keys corresponding to squares that are already occupied by an X or a 0. The game ends when either the player or computer has won or the grid is full. When this happens the player will be asked if he would like another game and should respond by pressing Y (for Yes) or N (for No).

The computer makes its moves by using the following algorithm:

- 1 Look for two 0's in a row with a space beside them. If you find this situation then place another 0 in the space and so win the game.
- 2 If you can't satisfy the above requirements then look for two X's in a row with a space between them. If you come across this situation plac a 0 in the space, so preventing your opponent from winning the game.
- 3 If neither of the above two steps can be carried out then pick a random, empty corner (squares 1, 3 7 and 9) and put a 0 in it.
- 4 If no steps have been carried out then search through all the corners and put a 0 in the first empty corner you come across.
- 5 If none of steps 1-4 can be completed then pick a random square anywhere on the board and put a 0 in it if it is empty.
- 6 If all the above steps fail search through each square on the grid and place a 0 in the first empty one you find.

Variables

LIN, COL	Store line and column values used when printing an X or a 0.
BOARD	An array of 9 bytes, each byte corresponding to a square on the grid. A byte contains 0 if the corresponding square contains a 0, 1 if the square contains an X and 2 if the square is empty.
BOX	Used by various words to store the value of a square.
CORNERS	An array of 4 bytes used to store offsets to be added to the value of BOARD to give the address of a corner.
CHAR	Used by words dealing with both X's and 0's (e.g. WIN). If this variable has value 1 then the word is dealing with an X. If the value is 0 then the word is dealing with a 0.
PLAYER, COMP	Used to keep the score for the player and the computer.

Forth Words

The words used in the program have the following effects when executed:

DEFINE	Used to produce User Defined Graphics.
PICTURE	Draws the grid onto the television screen, prints the scores for the player and computer and sets all bytes in the array BOARD to 2 (i.e. empty).
CO–ORDS	Finds the values of LIN and COL correson-ding to the square whose number is on top of the stack.
DRAWX	Draws an X on screen in the square whose top left hand corner is specified by the values of LIN and COL.
CLEAN	Checks to see if the square indicated by BOX is empty.
HIGH, LOW	Check tht the value of BOX is in the range 1-9.
XIN	Accepts a number from the keyboard and prints an X at the corresponding square.
DRAW-0	Draws a 0 in the square specified by BOX
2ROW	Checks if there are two X's or 0's in a row.
CORNER	Searches for an empty corner.
RANDOM	Produces a random number between 0 and the number on the stack. This word could be of use in other programs.
ANYSQUARE	Chooses a random, empty square.
SYSTEMATIC	Searches the entire grid to find an empty square.
RANDCORNR	Chooses a random, empty corner.
LOOK	Checks to see if a square is empty.
2INROW	Checks the whole grid to find two X's or 0's in a row.
FIND-0	Finds an empty square for 0.
NEWGAME?	Checks to see if Y or N is being pressed in response to the prompt given at the end of a game.
3LINE	Used to check for three X's or 0's in a row.
WIN	Checks to see if the player or computer has won the game.
FULL	Checks to see if there are no empty squares in the grid.
XWINS	Prints a message indicating that the player has won the game.
OWINS	Prints a message indicating that the computer has won.
XMOVE, 0MOVE	Lets the player or the computer make a move.
TIE	Indicates a draw.
XSTART, 0START	Lets the player or computer make the fist move.
PLAY	Draws the grid and then decides whether the player or computer will move first by using the word RANDOM.
RUN	Starts the game after compiling.

FORTH is a language which is becoming increasingly popular and widely used, especially in industry and schools, so I feel that more FORTH programs should be featured in the popular computing press. I hope that this program will encourage other FORTH enthusiasts to have more of their work published.

As well as being able to use SAVET to save screens to tape, it is also possible to save screens to the ZX Microdrive by using the following commands from FORTH:

```
MON (to re-enter BASIC)
NEW
CLEAR 50000
SAVE * "M";1;"Disc"-
CODE 53248, 11263
```

The above commands result in the obliteration of the FORTH compiler from memory and so should only be used at the end of a programming session.

To reload FORTH text screens from microdrive switch on the Spectrum and enter

```
CLEAR 50000
LOAD * "M";1;"DISC"
CODE 53248
NEW
```

Then load the FORTH compiler from tape as usual.

```
SCR # 1
( DEFINE GRAPHICS)
: DEFINE 8 * UDG + DUP 8 + S
WAP DO I C! LOOP ;
HEX
3C 3C 3C 3C 3C 3C 3C 3C 0 DE
FINE
0 0 FF FF FF FF 0 0 1 DEFINE
3C 3C FF FF FF FF 3C 3C 2 DE
FINE
FF FF FF FF FF E7 C3 81 3 DE
FINE
81 C3 E7 FF FF FF FF FF 4 DE
FINE
FF 7F 3F 1F 1F 3F 7F FF 5 DE
FINE
FF FE FC F8 F8 FC FE FF 6 DE
FINE
FF FE FC F8 F0 E0 C0 80 7 DE
FINE
1 3 7 F 1F 3F 7F FF 8 DEFINE
80 C0 E0 F0 F8 FC FE FF 9 DE
FINE
FF 7F 3F 1F 0F 07 03 01 A DE
FINE
DECIMAL
```

```
SCR # 2
( VARIABLES)
0 VARIABLE LIN
0 VARIABLE COL
0 VARIABLE BOARD 7 ALLOT
0 VARIABLE BOX
0 VARIABLE CORNERS 2 ALLOT
0 2 6 8 CORNERS 3 + C!
        CORNERS 2+ C!
        CORNERS 1+ C!
        CORNERS C!
0 VARIABLE CHAR
0 VARIABLE PLAYER
0 VARIABLE COMP
0 VARIABLE XVAL
0 VARIABLE YVAL
OK
```

```
SCR # 3
( SCREEN INITIALISATION)
: SLAT 6 AT ."   A   A" ;
: STRIPE 6 AT ." BBBBCBBBBB
CBBBBB" ;
: SETUP CLS 18 1 DO I SLAT L
OOP 6 STRIPE 12 STRIPE ;
: NUMS 3 8 AT ." 1 A 2 A
3" 9 8 AT ." 4 A 5 A 6"
15 8 AT ." 7 A 8 A 9" ;
: PICTURE SETUP NUMS BOARD 9
2 FILL 18 0 AT ." Spectrum:"
COMP @ . 18 22 AT ." Player:
PLAYER @ . ;

( PROGRAM ROUTINES)
: CO-ORDS
CASE 1 OF 1 6 ENDOF
     2 OF 1 12 ENDOF
     3 OF 1 18 ENDOF
     4 OF 7 6  ENDOF
     5 OF 7 12 ENDOF
     6 OF 7 18 ENDOF
     7 OF 13 6 ENDOF
     8 OF 13 12 ENDOF
     9 OF 13 18 ENDOF
ENDCASE
COL ! LIN !
```

```
SCR # 4
( PROGRAM ROUTINES CONTINUED
: DRAWX CO-ORDS
LIN @ COL @ AT ." H K"
LIN @ 1+ COL @ AT ." I  "
LIN @ 2+ COL @ AT ." FG"
LIN @ 3 + COL @ AT ." KE H"
LIN @ 4 + COL @ AT ." C  J"
1 BOX @ 1 - BOARD + C! ;
( BOARD CHECKING ROUTINES)
: CLEAN BOX @ 1 - BOARD + C@
2 = ;
: HIGH BOX @ 9 > NOT ;
LOW BOX @ 1 < NOT ;
: XIN BEGIN INKEY 48 - BOX !
LOW HIGH CLEAN AND AND UNTIL
BOX @ DRAWX ;
ok

SCR # 5
( FIND A SPACE FOR O)
: DRAW-O BOX @ CO-ORDS
LIN @ COL @ AT ." K H"
LIN @ 1+ COL @ AT ." KEH"
LIN @ 2+ COL @ AT ." C  J"
LIN @ 3 + COL @ AT ." I  U"
LIN @ 4 + COL @ AT ." IU"
0 BOX @ 1 - BOARD + C! ;
: 2ROW BOARD + C@ CHAR @ = S
WAP BOARD + C@ CHAR @ = AND ;
: CORNER BOARD 5 + C@ 2 = IF
9 BOX ! THEN
BOARD 6 + C@ 2 = IF 7 BOX !
THEN
BOARD 2 + C@ 2 = IF 3 BOX !
THEN
BOARD C@ 2 = IF 1 BOX ! THEN
;
: RANDOM 23672 @ ABS 16000 M
OD C@ * 255 / ;
: ANYSQUARE 500 0 DO 8 RANDO
M DUP BOARD + C@ 2 = IF 1+
BOX ! LEAVE ELSE DROP THEN L
OOP ;
: SYSTEMATIC 9 0 DO I BOARD
+ C@ 2 = IF I 1+ BOX ! THEN LOOP
;
: RANDCORNR 99 0 DO 3 RANDOM
CORNERS + C@ DUP BOARD + C@ 2 =
IF 1+ BOX ! LEAVE ELSE DROP
THEN LOOP ;

SCR # 6
( BOARD SEARCHING ROUTINES)
: LOOK BOARD + C@ 2 = ;
: 2INROW
0 LOOK IF 1 2 2ROW 4 8 2ROW
3 6 2ROW
OR OR IF 1 BOX ! THEN THEN
1 LOOK IF 0 2 2ROW 4 7 2ROW
OR IF 2 BOX ! THEN THEN
2 LOOK IF 0 1 2ROW 4 6 2ROW
5 8 2ROW
OR OR IF 3 BOX ! THEN THEN
3 LOOK IF 0 6 2ROW 4 5 2ROW
OR IF 4 BOX ! THEN THEN
4 LOOK IF 0 8 2ROW 2 6 2ROW
1 7 2ROW 3 5 2ROW
OR OR OR IF 5 BOX ! THEN THE
N
5 LOOK IF 2 8 2ROW 3 4 2ROW
OR IF 6 BOX ! THEN THEN
6 LOOK IF 0 3 2ROW 2 4 2ROW
7 8 2ROW
OR OR IF 7 BOX ! THEN THEN
7 LOOK IF 1 4 2ROW 6 8 2ROW
OR IF 8 BOX ! THEN THEN
8 LOOK IF 2 5 2ROW 0 4 2ROW
6 7 2ROW
OR OR IF 9 BOX ! THEN THEN ;
ok

SCR # 7
( FINDING SPACE FOR O)
: FIND-O 0 BOX ! 0 CHAR ! 2I
NROW BOX @ 0= IF 1 CHAR ! 2INROW
THEN BOX @ 0= IF RANDCORNR
THEN BOX @ 0= IF CORNER THEN
BOX @ 0= IF ANYSQUARE THEN B
OX @ 0= IF SYSTEMATIC THEN ;
: NEWGAME? BEGIN INKEY DUP 7
8 = SWAP 89 = OR UNTIL INKEY ;
: 3LINE DUP C@ 2 = IF DROP D
ROP DROP 0 ELSE C@ CHAR @ = SWAP
C@
CHAR @ = ROT C@ CHAR @ = AND
AND THEN ;
: WIN 3 0 DO I BOARD + DUP 3
+ DUP 3 + 3LINE LOOP OR OR
7 0 DO I BOARD + DUP 1+ DUP
1+ 3LINE 3 +LOOP OR OR
BOARD DUP 4 + DUP 4 + 3LINE
BOARD 2 + DUP 2 + DUP 2 + 3L
INE
OR OR OR ;
: FULL 1 9 0 DO I BOARD + C@
2 = IF DROP 0 THEN LOOP ;
: XWINS PLAYER @ 1+ PLAYER !
21 2 AT
." You Win. Another game ? (
Y/N)" ;

SCR # 8
: OWINS 21 3 AT ." I Win. An
other game (Y/N)" COMP @ 1+ COMP
! ;
: XMOVE 20 10 AT ." Your Mov
e" XIN 20 10 AT ."          " ;
1 CHAR ! WIN FULL OR NOT ;
: OMOVE FIND-O DRAW-O 0 CHAR
! WIN FULL OR NOT ;
: TIE 21 2 AT ." We Draw. An
other game ? (Y/N)" ;
: X-START BEGIN XMOVE DUP IF
DROP OMOVE THEN NOT UNTIL ;
: O-START BEGIN OMOVE DUP IF
DROP XMOVE THEN NOT UNTIL ;
: PLAY PICTURE 10 RANDOM 5 >
IF X-START ELSE O-START THEN
FULL IF TIE THEN 0 CHAR ! WI
N IF OWINS THEN 1 CHAR ! WIN
IF XWINS THEN NEWGAME? ;
: RUN 0 PLAYER ! 0 COMP ! BE
GIN PLAY 89 = NOT UNTIL ;

SCR # 9
: LOADER CLS 10 12 AT ." COM
PILING" 9 1 DO I LOAD LOOP
10 12 AT ." READY     " ;
```

Club corner



Universal Club

Dear ZX Computing,
Would you be so kind as to publish this letter.

Members of our club. which is world wide, communicate via tapes and letters and exchange programs, programming tips etc.

May I stress the fact that no membership fees are involved, the only cost being the price of postage. All enquiries are welcome, but must contain an SAE.

Yours sincerely,
C. Shaw
Universal ZX Club
1 Swiss Walk, Batley
W. Yorks.

Pen Pal

Dear ZX Computing,
I'm fourteen years old and I would like a pen pal. I live in Sweden and own a 48K ZX Spectrum.

Magnus Andersson
Ladamnesgatah 2
416 79 Goteborg
Sweden

Pen Pal II

Dear ZX Computing,
After buying my first copy of your excellent magazine, I would like to find a pen pal from anywhere on the globe. I am fourteen years old, and I would like to hear from anyone who has written any commercial software or software that they have written themselves.

Yours faithfully,
Junior Harris
95 Garfield Ave.
Heaton, Bradford
W. Yorkshire

Pen Pal Strikes Back

Dear ZX Computing,
I am a regular reader of your magazine and find it a good magazine to read, so good that I make sure that I don't miss a single issue.



So many readers have been helped by your good work that I had to write to you. I own a 48K Spectrum with Seikosha GP 250x printer, interface 1 with microdrive, and interface 2. I am looking for someone to correspond with as a pen pal, and would be grateful if anyone wishing to help me out would contact me.

Yours sincerely,
Mike de Bruyn
27 Ridge Road
Park Town, Johannesburg
2193
S. Africa.

Toronto

Dear ZX Computing,
I wonder if I could use your Club Corner to acquaint Sinclair users with our club. It is the Toronto Timex-Sinclair Users Club.

We meet twice a month and publish a bimonthly newsletter. Our membership is drawn primarily from the Toronto area, though we have members all across Canada. Our dues are $20 annually. We are interested in exchanging newsletters with other clubs.

Sincerely,
George Chambers
Pres. Toronto Timex-Sinclair Users Club
PO Box 7274 Stn A. Toronto
Ontario, Canada M3W 1X9

WA ZX

Dear ZX Computing,
Since your mention of the WA ZX Users Group back in September '84, our membership has doubled, and a lot of the credit is yours. Many new members first read about us in your magazine.

We reckon to the the best, if not the biggest, Spectrum Group in Australia, and though based in one of the least populous cities, have members all over Australia. Interstate members will find our $5 annual subscription a bargain!

We are at present awaiting the arrival of a Wafadrive for testing and demonstration, after which it will be sold, raffled, or used as a competition prize. Tests of other such accessories will be done as they appear.

The Spectrum could still be a money spinner for an enterprising distributor here. Unfortunately the national distributor is far away, and the Home Computer market is dominated by the most advertised product. I can't remember seeing one local Sinclair advertisement! Naturally we look mostly to the UK for hardware. It is quicker and cheaper to have repairs done in England too, though when we form a business arrangement with a British supplier the shortage of chips etc will be overcome and the local repairmen will be able to do much better that hitherto.

Our address remains as before:

C/O Garth Gregson
Hon Secretary
WA ZX Users Group
34 Chester St.
South Fremantle 6162
PHONE: 335 1671.

Christian Users

Dear Sir,
We would appreciate your mentioning the newly formed 'Christian Micro Users Association'. We hope to link together a large number of Christian micro users and also to promote the use of micros in Church activities.

There is not only a need to discover the few individuals and companies producing 'Christian' software, but also to share the expertise and ideas of many people who have sought to use micros in their church related activities.

For further details and a sample magazine, send a large SAE to the following address:

Yours sincerely,
P.A. Clark (Secretary)
Christian Micro Users Association
c/o 6 Walkley Street
Sheffield S6 3RG

Dear Mr(?) Clark,
On the subject of 'Christian' software, it might be worth your while to contact Magination Software, 47 Clifton Road, Newcastle upon Tyne, who, I believe, have plans to produce some programs along those lines.

Finally I would just like to give a plug to Don Barnard of the National Timex-Sinclair Network, PO Box 152214, Red Bank, Tennessee 37415, USA.

ZX COMPUTING

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48k Spectrum owners with Micro/Wafa/Disc drives can NOW transfer the MAJORITY of their programs (inc headerless, long programs, + those with LOW addresses - say 16384) with our newly IMPROVED package (inc bytes chop/split in one go, VAL creator (reduced Tasword by 1000+ bytes in 2 secs) remkill, make visible, etc, etc).

To transfer from tape you must convert the program, and then transfer the converted bytes. MD1b (or WD1B) has the programs giving you the tools to do the modifications to get them running. MD1 also has extra program for easy multiple erasing, and TRUE cat. They have a new manual with example transfers and exercises.

This widely acclaimed program (see Your Spect. No 9. P14) is ESSENTIAL if you are going to transfer MOST of your programs to your drive. Try it and see for yourself - no risk!

MD1b (WD1b for disc or Wafadrive owners) costs a mere **£6.99**

As an EXTRA option to conveniently transfer converted bytes, with integrated header reader, option to alter program names, STOPS programs, etc, we have MT6 at **£3** (for M/drive), or Wafatape at **£4** (for Wafadrive) owners.

UPDATE SERVICE: old customers can get the latest version on any product with a **£2** reduction by sending old TAPE only, + SAE (large).
ALL PRODUCTS CARRY OUR MONEY BACK GUARANTEE (not updates)
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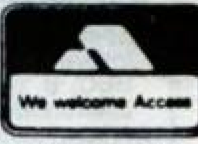
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